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WATER PRICING IN ZANZIBAR:

EFFECTS OF VOLUMETRIC TARIFF ON RESIDENTIAL WATER CONSUMPTION

by

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A dissertation submitted in partial fulfillment of the requirements

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List of Abbreviations

ADB	Asian Development Bank
AIC	Average Incremental Cost
AICD	Africa Infrastructure Country Diagnostic
ANOVA	Analysis of Variance
AUWSA	Arusha Urban Water and Sewerage Authority
DAWASA	Dar es Salaam Water and Sewerage Authority
DWD	Department of Water Development
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
FY	Financial Year
IBT	Increasing Block Tariff
IBNET	International Benchmarking Network for Water and Sanitation Utilities
IWA	International Water Association
JICA	Japan International Cooperation Agency
MWCEL	Ministry of Water, Construction, Energy and Lands
NRW	Non-Revenue Water
OPEX	Operating Expense
RGZ	Revolutionary Government of Zanzibar
Tsh	Tanzanian Shillings
TVZ	Television Zanzibar
UNDP	United Nations Development Programme
VDT	Volume-Differentiated Tariff
WEDC	Water, Engineering and Development Centre
WWF	World Wide Fund for Nature
ZAWA	Zanzibar Water Authority
ZECO	Zanzibar Electricity Company

Chapter 1. Introduction

1.1. Background

Water pricing is essential for sound management of water supply services. However, it is not easy to collect sufficient amount of revenue. Even the water utilities in the industrialized countries face difficulties in revenue sufficiency and much more for those in the developing countries. In many water utilities in the developing countries, the price of water tariff is set too low or sometimes water is free. In such cases, water utilities cannot maintain their deteriorating assets due to limited financial resources. As a result, customers receiving the poor services lose their willingness to pay for water and accordingly revenue collection will become more challenging for utilities. Nevertheless, there is no other option but to collect the revenue from the customers in order to get rid of the vicious circle.

Although the situation is better than free of charge, the water utilities in the developing countries which are using the fixed rate, especially in low price, often face some troubles because the customers can consume the water as much as they can. In contrary, water is often scarce in developing counties. When enough water is not supplied to the customers and water pressures or service hours differ among them, they will be filled with feeling of unfairness. However, as a matter of fact, many water utilities are still charging water with fixed rate.

Generally, volumetric tariff, which charges the customers according to their water consumption is said to be better than the fixed rate for conservation of water. However, literatures that investigated the empirical effects on water consumption by changing the tariff structure from fixed rate to volumetric tariff rarely exist. The topics of available literatures on water tariff are concentrated on estimation the price elasticity of demand after modeling the water demand or investigation of the ideal tariff structure among the various types of volumetric tariff.

In consideration of existence of vast number of unmetered customers and rapid urbanization in developing countries, it is predicted that the number of water utilities that will be required to change their tariff to volumetric structure in the near future is not small. However, empirical evidences of how the volumetric tariff effects on water consumption in the developing countries are lacking. In this research, effects caused by the transition from fixed rate to volumetric tariff structure on residential water consumption were investigated. The findings from this research would be beneficial for those utilities which are planning to introduce volumetric tariff for domestic users.

1.2. Zanzibar Water Authority

This research studies the case of Zanzibar Water Authority (ZAWA), the water utility in Zanzibar. Zanzibar is a part of the United Republic of Tanzania governed by the Revolutionary Government of Zanzibar (RGZ) since 1964. It is located at 32 kilometres off the mainland (RGZ, 2014). According to the national census carried out in 2012, 1.3 million people live in the islands of Unguja, Pemba and neighbouring small islands (The United Republic of Tanzania, 2013, pp. 2). The population's 98 percent is Muslim (U.S. Department of State, 2012, pp.1).

ZAWA is a relatively new water utility, which was devolved from the Ministry of Water, Construction, Energy and Lands (MWCEL) in 2006. ZAWA has a responsibility to supply water for both urban and rural areas in the Unguja and Pemba Islands. When ZAWA was established, water was free for domestic users and thus their business was largely dependent on the governmental subsidies. Their infrastructures were deteriorated due to lack of investments and maintenances. Despite the unfavourable situation, ZAWA started to charge the domestic customers with fixed rate in 2008 and introduced the volumetric tariff in the pilot scale from 2010. ZAWA is one of the unique water utilities that is trying to find the way out from the vicious circle caused by the free water policy, by commencing the water pricing operation and introducing the volumetric tariff.

This case study on ZAWA's experience on introducing the volumetric tariff is transferrable to other cases, not only to the wider areas in Zanzibar but also to the water utilities in the developing countries aiming to introduce the volumetric tariff.

Picture: Headquarters of Zanzibar Water Authority

1.3. Aim and Objectives

The research aim and questions are shown in **Box 1-1**. The aim would be achieved by answering three questions. Through the first and second research questions, contextual situations related to the change of tariff structure were investigated. The effects of volumetric tariff on residential water consumption were analysed in the third question. Changes in water consumption and the determinants of water consumption which be might affected the changes of water consumption were investigated.

Box 1-1: Research aim and questions

Aim

To investigate the effects of volumetric tariff on residential water consumption in the Urban District of Zanzibar

Questions

1. What was the water service situation of ZAWA before the introduction of volumetric tariff?
2. What was the process of introducing the volumetric tariff?
3. What are the effects of volumetric tariff on residential water consumption?

1.4. Dissertation Structure

The dissertation consists of five chapters. Introduction (Chapter 1) describes the background and framework of the research. Literature review (Chapter 2) was carried out to learn the insights and methodologies for answering the research questions from the existing literatures. Methodology (Chapter 3) explains the methodological approach and research design employed in this research. Results and Analysis (Chapter 4) were presented based on the collected data and the Conclusion and Recommendations (Chapter 5) summarizes the dissertation by revisiting the research aim and objectives, and pointing out the limitation of the study. Recommendations for ZAWA and future researches were also mentioned in the conclusion.

Chapter 2. Literature Review

Literature review was conducted to collect and analyse the existing information related to the research topic. In detail, the objectives for the literature review were: 1) to develop the insights on the research topic; 2) to obtain a latest view of the research topic; 3) to identify the gaps on current knowledge; 4) to establish links between this research and other research on the related topic; and 5) to learn about appropriate research methods to answer the research questions.

The first section 2.1 describes the review strategy employed in this literature review. Sections from 2.2 to 2.8 in this chapter correspond to the specific questions shown in **Table 2-1**. The findings from the literature review enabled to elaborate the required data for answering the research questions, which were summarized in section 2.9.

Table 2-1: Specific questions for the literature review

Section	***Specific Questions for the Literature Review***
2.2 Importance of water pricing for water supply services	• Why is water pricing important for the water supply services in developing countries?
2.3 Demand curve and price elasticity of demand	• How does price affect the water demand?
2.4 Objectives of water tariff	• What objectives should tariff meet?
2.5 Tariff structures	• What are the common types of tariff in developing countries and what are the advantages and disadvantages of those tariffs?
2.6 Procedures for introducing the volumetric tariff	• What are the key drivers for the utilities to introduce the volumetric tariff and what is the required process for the introduction?
2.7 Determinants of water consumption	• What are the potential determinants of water consumption?
2.8 Water consumption analysis	• What methods are used for analysing the water consumption and their determinants?

2.1. Review Strategy

Literature review was carried out with the process shown in **Figure 2-1**. At the onset of the literature review, a list of potential sources was developed. **Table 2-2** shows the list of potential sources of literatures. Numerous literatures were available since the topic of water

pricing has been researched in several contexts such as water demand management, willingness to pay, cost recovery and demand forecasting. Therefore, long-list of literatures was developed by searching the sources with the relevant keywords and then narrowed down by going through their titles and abstracts. The keywords used were: water supply, water consumption, water demand, cost recovery, tariff, willingness to pay, consumer, customer, user, determinants and factors. These keywords were combined in a various ways and quotation marks and wildcard characters were used to avoid unnecessary omission of the literatures. The long-list created from the keyword searching included 564 literatures and they were narrowed down to 36 literatures. While reading the extracted 36 literatures in depth, 14 literatures cited in the documents were added, which made the final number of the literatures to 50. The websites of the selected researchers who frequently appeared in the literatures were also browsed to find the unpublished literatures, however, literatures found from this searching method were already covered in the previous search. In addition, some other literatures were also browsed to gain the knowledge from latest literatures.

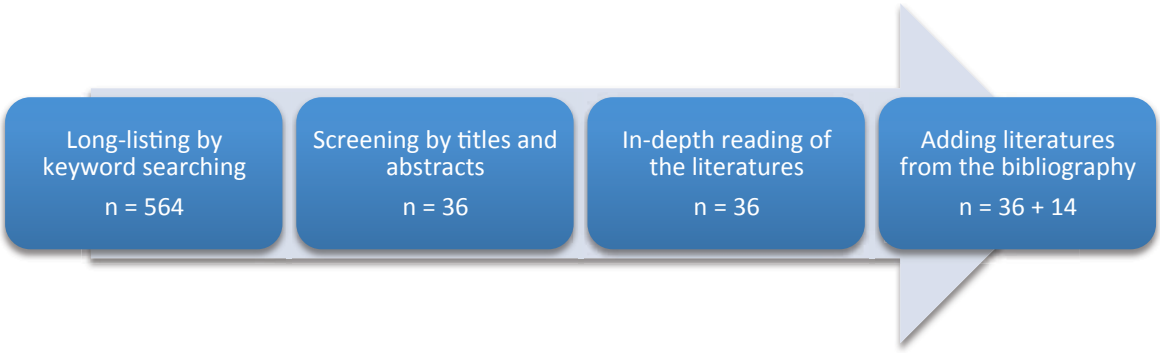


Figure 2-1: Selection process of literatures

Table 2-2: List of potential sources of literatures

Type of literatures	*Specific sources*	*Means to access sources*
Publications by development agencies	• The World Bank • Asian Development Bank	• Organization websites • Google • WEDC Knowledge base
Publications by other international and governmental agencies	• IWA • WWF • Governmental agencies	• WEDC Knowledge base • Google
Published journals and academic papers	• Journals on water resources, economics and development	• Library Catalogue Plus • Google Scholar
Unpublished papers, MSc projects	• WEDC • Academic documents from selected researchers	• WEDC Knowledge base • Personal websites

Evaluation of the literatures was made at each stage of the selection process. First, in the long-listing stage, only the peer-reviewed papers were searched from the Library Catalogue Plus by searching from the selected databases; Civil Engineering Abstracts, Aqualine and Water Resources Abstracts. The literatures published within a decade were prioritized to review the up-to-date literatures. However, exceptions exist as few literatures published in 1990s were frequently cited in the recent literatures and contained essential information.

Second, in the screening stage, when it was difficult to judge the relevancy of the contents from its title and abstract, the main document was skimmed. Since many literatures were using the econometric techniques and multiple regression analysis, pre-reading of those analytical methods was necessary to understand the methodologies employed in the literatures.

Third, in the in-depth reading stage, if the author belonged to unknown institute and did not have reliable affiliation, references cited in the document were carefully checked. If the selection of references seemed to be too biased from the author's own perspective, reliability of the literature was questioned. When the literature was referring to the statistic data from the other source, the original source was also reviewed in order to understand the data without misinterpretation.

2.2. Importance of Water Pricing in Water Supply Services

Many of the water supply systems in the developing countries were constructed in colonial eras. Although the trend of urbanization since that time, infrastructures have not been able to keep pace with urban development (Rouse, 2013, pp. 301). Whittington (2003, pp. 62), referring to the urban water supply in South Asian countries, states that status quo is already bad, but attributing to the continuous increase in the urban population, the future for municipal water supply services looks even worse. In addition, many developing countries have considered water as a social service and adopting a policy of supplying water free or almost free of charge (Katko, 1990, pp. 86).

If water is for free or almost free, then the water utility cannot generate sufficient revenue. The low revenue will create three vicious circles as shown in **Figure 2-2**. The first circle is related to institutional aspects. If utilities cannot generate sufficient revenue, water supply services will be dependent to the subsidies from someone else. According to Whittington, the "someone else" is typically one of three groups: the state, the international community or industry (Whittington, 2003, pp. 64). This subsidies lead to lack of initiatives and decline the performance of the water utilities. The second circle is related to organizational aspects. Low

salary of the utility staff will reduce their motivation and leads to low organizational performance. The third circle is related to the customers. Deteriorated water supply services will make the consumers discontent and thus makes it difficult for the utilities to generate the sufficient revenue to maintain the system adequately.

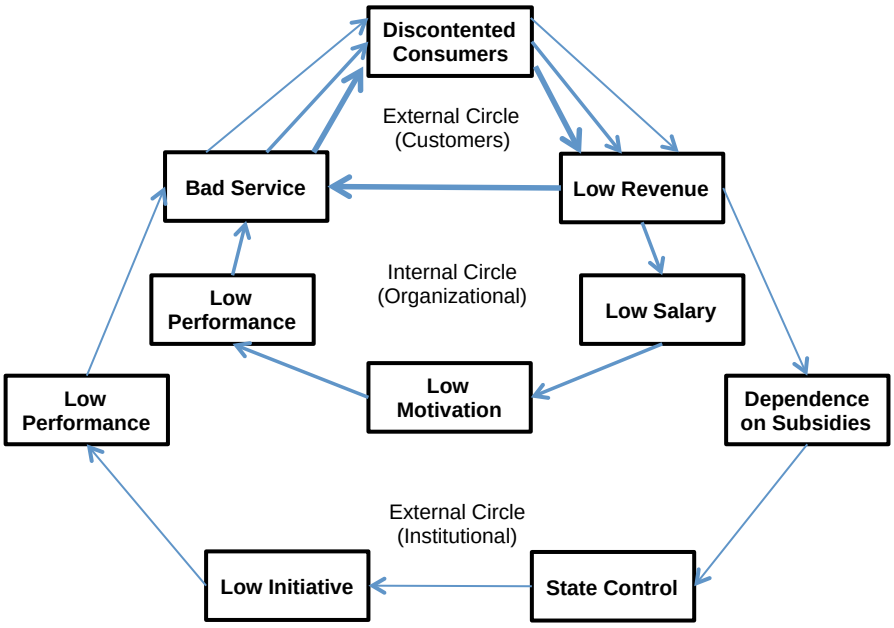


Figure 2-2: Vicious circles of water service decline

(Source: adopted from Rouse, 2013, pp. 305)

Water pricing is commonly agreed as essential for cost recovery of water supply services. Savenije and Zaag (2002, pp. 100) stated that water pricing is an important instrument to break the vicious circle of the “free water dilemma” and Rogers et al. (2002, pp. 5) stated that the only way to ensure that everyone has access to water is to ration it in some way and perhaps the best way to utilize water to the best and most-valued uses is to put a price on water. Rouse (2013, pp. 307) stated the strong message that there is no known alternative to sustainable cost recovery from water charges.

Considering the importance of water pricing to cut the vicious circles, water pricing has impacts on various areas of water supply services in both external and internal circumstances. It affects to institutional and organizational performances as well as physical conditions such as water supply situation. Water pricing is prerequisite for sustainable water supply services.

2.3. Demand Curve and Price Elasticity of Demand

Water is not the exception of the supply and demand theory. Understanding of water demand is a critical step in the economic analysis of water supply projects because the demand analysis will enable the planners to: 1) determine the service level to be provided; 2) determine the size and timing of investments; 3) estimate the financial and economic benefits of the project; and 4) assess the ability and willingness to pay for the project beneficiaries. When conducting the water demand analysis, the one should consider the marginal cost for delivering water as the demand changes by the price imposed to the users. Thus, “effective demand” for water is defined as the quantity of water demanded of a given quality at a specified price (ADB, 1999, pp. 40).

It is important to define the difference between “effective demand” for water and “actual consumption” of water. Water consumption is the actual quantity of water consumed whereas effective demand relates that quantity to the price of water. For example, a low level of water consumption may not represent effective demand but may instead indicate a constraint in the existing supply of water (ADB, 1999, pp. 40).

The price of water is one of the important determinants of water consumption. The example of relation between the quantity of water used and the price is illustrated in **Figure 2-3**. The downward sloping curve illustrated by D_1D_1 indicates the decrease in marginal value. (D_2D_2 is shown just for illustrative purpose). The primary use of water necessary to sustain life is extremely valuable as shown in the curve. Then the marginal value of water tends to decline as the individual is putting the water to less valuable uses.

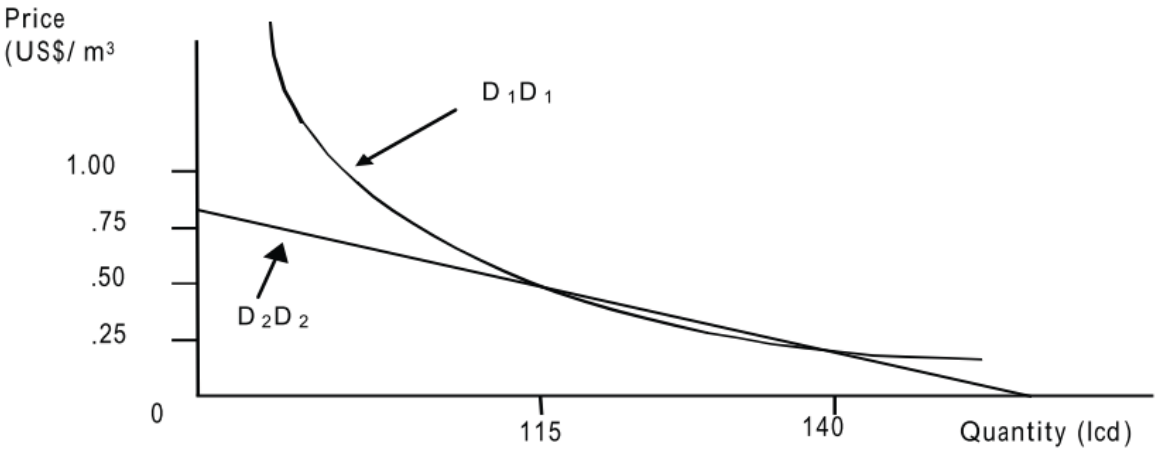


Figure 2-3: Individual’s water demand curve

(Source: ADB, 1999, pp. 43)

Based on the principle described in the water demand curve, the price elasticity of demand is a measure that describes the degree of responsiveness of the quantity of water to a given price change. It is measured as the percentage change in demand divided by the initiating percentage change in price. The price elasticity of demand for water is normally negative because the demand curve is sloping downward. If the absolute value of price elasticity of demand is less than 1, demand is inelastic. Whereas, if the absolute value of price elasticity of demand is greater than 1, demand is elastic.

Generally, households with higher incomes are able to pay more for a given quantity of water than households with lower incomes. However, people with higher incomes pay smaller percentages of their incomes for water than people with lower incomes (ADB, 1999, pp. 46). The relation between water consumption and income can be measured as income elasticity. It is measured as the proportional change in demand divided by the percentage change in income. The terms inelastic and elastic are applied for income elasticity similarly with price elasticity of demand.

Many literatures estimated the price elasticity of demand and income elasticity for water. Nauges and Whittington (Nauges and Whittington, 2010, pp. 285) reviewed the literatures that used data from utilities and household surveys to estimate household water-demand functions in developing countries and summarized that price elasticity for water from private connection is in the range from -0.3 to -0.6 and that income elasticity is typically in the range of 0.1 to 0.3. Referring to the review of Komives et al. (2005, pp. 18), mean of price elasticity for residential water was -0.38 and income elasticity was 0.36. Jansen and Schulz (Jansen and Schulz, 2006, pp. 604) estimated the high price elasticity of water for the higher income groups than the lower income groups in Cape Town and stated that the similar results were well documented in the existing literatures.

The estimations of price elasticity of demand and income elasticity based on the empirical data illustrate that water for basic needs is inelastic compared to the other uses as described in the water demand curve. In other words, households with lower income tend to be more price inelastic than the households with higher income as poor cannot afford the price for less marginal values and thus use water mainly for high marginal values. Some of the tariffs are designed to utilize this relation between demand, price and different income levels.

2.4. Objectives of Water Tariff

A water tariff is an important management tool for water pricing reform. Several objectives need to be considered in the tariff design. According to Boland (1993, pp. 7), the “best” tariff

design is the one which strikes the most desirable balance among the objectives shown in **Box 2-1**.

Box 2-1: Objectives need to be considered in the tariff design

- ***Economic Efficiency*** – The tariff should promote patterns and levels of water use which tend to minimize the total cost of meeting the service area's water needs.
- ***Fairness*** – The tariff should be perceived as fair by water users and the public.
- ***Equity*** – The tariff should treat equals equally. Among other things, this means that all who purchase water with the same cost should pay the same price.
- ***Revenue Sufficiency*** – Taking one year with another, the tariff should provide the needed revenue to support the utility's operations, maintenance activities, pay-as-you-go capital outlays, and debt service.
- ***Net Revenue Stability*** – Net revenue is the excess of cash receipts over outlays. Tariff design should minimize changes in net revenue due to unexpected fluctuations in demand.
- ***Simplicity and Understandability*** – The tariff should avoid unneeded complexity, and be readily understandable to water users and others who are expected to make decisions based on water prices.
- ***Resource Conservation*** – The tariff should promote conservation of scarce resources.
- ***Rate Shock*** – Tariff implementation should avoid large increases in the total bill paid by any individual customer. Where such increases are called for by a change in tariff design, they may need to be implemented in two or more steps.
- ***Ease of Implementation*** – A new tariff may require additional metering or other data, new billing procedures, or other implantation effort. In this case, the implantation procedure should provide for a smooth, efficient transition from the old to the new procedures.
- ***Bond Ratings*** – In addition to other objectives stated above, it may be necessary for the utility to demonstrate its ability to meet its obligations to bondholders.

Source: Boland, 1993, pp.7

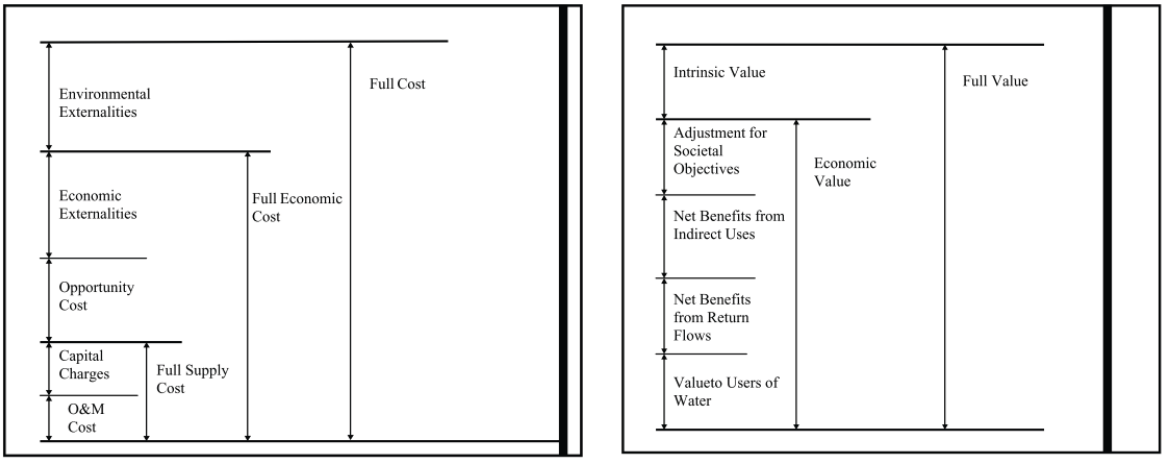
Out of the above objectives, Vairavamoorthy and Mansoor (2006, pp. 199), Sansom et al. (2004, pp. 143) and Whittington (2003, pp. 63) recommended the objectives of tariff for the low-income countries. Vairavamoortht and Mansoor, and Sansom recommended the "CAFES" Principle (or in other words, "AESCE" Principle), which consists of ***Conserving*** (corresponds to *Resource Conservation*), ***Fair*** (corresponds to *Fairness* and *Equity*), ***Adequate*** (corresponds to *Revenue Sufficiency* and *Economic Efficiency*), ***Enforceable*** (corresponds to *Ease of Implementation*) and ***Simple*** (corresponds to *Simplicity and Understandability*).

Whittington recommended ***Revenue Sufficiency***, ***Economic Efficiency***, ***Equity*** and ***Poverty Alleviation*** as four main objectives required in the developing countries. Although the terminologies for the objectives recommended by those researchers were different, they were indicating the common objectives. The four objectives recommended by Whittington were discussed in detail in the following paragraphs.

With regard to the ***Revenue Sufficiency***, Consumers and suppliers of water have different expectations for water tariffs. Consumers prefer to high quality water at and affordable and stable price, whereas suppliers' main purpose of the tariff is often cost recovery (Rogers, 2002, pp. 5; Whittington, 2003, pp. 63). Savenije and Zaag (2002, pp. 103-104) stated that the core function of water pricing should primarily be cost recovery instead of water demand management, even though it has been frequently discussed in the existing literatures.

Regarding the ***Economic Efficiency***, each individual user must compensate the utility for the cost of replacing the water used for the utilities to provide the service at the lowest possible social cost. If water users experience benefits which exceed such a price, they will increase use. If some use of water is expected to provide a benefit which is smaller than the price, they will decide not to use the same amount of water (Boland, 1993, pp. 7-8). Therefore, from an economic efficiency perspective, a tariff should create incentives that ensure, for the given water supply cost, the users obtain the largest aggregate benefits.

Rogers et al. (2002, pp. 3) defined the costs, benefits (value) and price distinctly as three important concepts from water economics in a wider perspective of integrated water resource management as shown in **Figure 2-4**. *Economic Externatlities* are the cost associated with the pervasive externalities e.g. upstream diversion of water, over-extraction or contamination of water resources. *Value to Users of Water* is the marginal value of product reflects the willingness to pay; whereas *Net Benefits from Return Flows* are the effects of hydrological return flows e.g. recharge of the groundwater from the water diverted to the irrigation. *Net Benefits from Return Flows* are the benefits coming from indirect impacts e.g. improved health and/or higher incomes for the rural poor. *Adjustment for Social Objectives* is for the values that are over and above the water e.g. poverty alleviation and food security (Rogers et al., 1998, pp. 6-14). Adapting the concept to water pricing for water supply services, ***Operation and Maintenance Cost***, ***Capital Charges*** and ***Opportunity Cost*** would best fit for the cost to be targeted for recovery. As for the value, ***Value to Users of Water*** and ***Net Benefits from Indirect Uses*** can be regarded as benefits from water supply.



Price: Amount set by the political and social system to ensure cost recovery, equity and sustainability. The price may or may not include subsidies. Prices for water are not determined solely by cost.

Figure 2-4: General principles for cost, value and price of water

(Source: Rogers et al., 2002, pp. 3)

Based on the objective of ***Economic Efficiency***, water tariff should be set equal to the marginal cost of supplying water to ensure the future benefits. In consideration of the above definitions, tariff should cover both operation and maintenance cost and the cost for future investment. Marginal cost of supplying water can be approximated by the average incremental cost (AIC) (Whittington, 2003, pp.63).

Coming back to the remaining two main objectives of the water tariff, ***Equity*** means that the water tariff should treat similar customers equally, and that customers in different situations are not treated the same. This is usually interpreted as requiring user to pay monthly water bills that are proportionate to the costs they impose on the utility by their water use. Boland (1993, pp. 8) discussed the difference between equity and fairness. Equity is an objective criterion while fairness can be defined in subjective terms. Tariffs are fair when they are perceived, by customers and by general public to be just and equitable, not offering improper advantage to any group of customers.

The last objective, ***Poverty Alleviation*** is an objective that is conflicting with the concept of cost recovery. This objective leads many people towards the “free water” policy, as water is a human right and it is indispensable for leading a life in human dignity (UN, 2014). Whittington (2003, pp. 63) argued that the free service become less valuable to households ironically due to declined service quality itself. Subsidizing water to the poor is another discussion. There are

variable ways to subsidy the water services to lower the water prices for the poor. However, subsidy approach carries the same risk with “free water”. There is a risk that the government will fail to deliver the promised services (Komives et al., 2005, pp. 14-15).

Enforcement of the water tariff which satisfies or balances these objectives are challenging especially in the developing countries due to the following reasons. First, with regard to the ***Revenue Sufficiency***, operation and maintenance cost is always high in the deteriorated water supply systems due to the large amount of physical losses of water produced and required manpower for frequent repairs. Billing and revenue collection are difficult due to the limited capacity of the water utilities and discontent customers for poor services. When fixed charge is employed, there is a technical issue on unmetered connections as there is no incentive for the users to save water and utilities will be required to produce more water (Blanc, 2008, pp. 8).

Second, as for the ***Economic Efficiency***, Sansom et al. (2004, pp. 147-148) stated that although marginal cost pricing is optimum, it is difficult to apply in practice in developing countries due to unmanageable fluctuations in the marginal cost of water production and large size of the water supply investments. In addition, if the utility has been subsidized by the higher authority, the utilities are often pressurized by the subsidizers to improve the revenue sufficiency in short-term and the long-term future investment plan is neglected. According to Rouse, the life of government is short comparing with water and supply planning horizons (Rouse, 2013, pp. 306).

Economic objectives are challenging for many water utilities in low-income countries. In reality, many utilities are not recovering even the operating expense (OPEX). According to the statistics provided in IBNET (The International Benchmarking Network for Water and Sanitation Utilities Databook), 43 percent of the 930 water utilities were unable to cover their basic operation and maintenance cost in 2008 (Berg and Danilenko, 2011, pp.23). The realistic initial target for the most of the water utilities in the developing countries would be designing the tariff that could recover their OPEX.

Third, regarding ***Equity***, the coverage of meters largely varies among the water utilities. According to the data from IBNET and Africa Infrastructure Country Diagnostic (AICD) that investigated the 86 water utilities in African countries, out of 83 utilities, 18 percent of the utilities reported no meter coverage, 31 percent of the utilities reported less than 50 percent of residential connections were metered, 13 percent of the utilities reported 50 to 70 percent of residential connections were metered, and 39 percent of the utilities reported that more than 70 percent of the residential connections were metered (Banerjee and Morella, 2011, pp. 134). Another study found that only 50% of the households were metered in the small cities in India. It also reported that meters were often non-functional either due to the low quality of the

equipment, intermittent nature of water supply, or deliberately tampered with by the households (Raghpati and Foster, 2003, pp.6). These pictures indicate the existence of tremendous challenge for installing the meters in the developing countries. In addition, the poor group needs special consideration in the development context. Providing water to the poor with the same price with the other customers may lose the fairness.

At last, practices aiming to achieve the objective of ***Poverty Alleviation*** are commonly enforced without consideration of the other objectives, especially by politicians. In other words, there is a political fear of raising tariffs. In this regard, Whittington (2003, pp.62) pointed out the lack of empirical evidence for implementing different tariffs, which enables someone to generate reasonable level of confidence. How changes in water prices would affect the quantity of water different customers would use, and customers' decisions to connect to the water distribution system. Additionally, there is no market test for different tariff structures.

2.5. Tariff Structures

Tariff structures are the critical component of water pricing reform. Despite the fact that there is a consensus on the importance of water pricing, tariff structure is the controversial area. There are varieties of tariff structures used for water supply services. **Figure 2-5** shows the water tariff structures most commonly used by utilities.

- ***Fixed Charge (Flat Rate)***: the bill does not depend on the quantity of water consumed
- ***Volumetric Charge***: the bill depends on the quantity of water consumed
  - ***Uniform Rate***: all units (cubic metres) are priced at the same rate, independently of total consumption
  - ***Non-Uniform Rate***: units are priced differently
    - ***Block Tariff***: all units are priced differently
      - ***Increasing Block Tariff (IBT)***: the marginal rate increases with the block
      - ***Decreasing Block Tariff***: the marginal rate decreases with the block
    - ***Volume-Differentiated Tariff (VDT)***: all units are priced at the same rate, but the rate depends on total consumption
- ***Two-Part Tariff***: composed of a fixed charge plus a variable charge which depends on the quantity of water consumed
  - ***Uniform Two-Part Tariff:*** the fixed charge and the volumetric rate are the same for all connections
  - ***Differentiated Two-Part Tariff***: there is a menu of services with different sets of fixed charges and rates
- ***Fixed Charge plus Volumetric Rate***: combine fixed charges with the tariffs above (e.g. IBT)

Figure 2-5: Common water tariff structures used by utilities
(Source: Blanc 2008, pp. 8)

First, water consumption can be metered or unmetered. From an economic perspective, water use should be metered, and a volumetric rate charged for consumption. When water consumption is not metered, utilities charge a fixed rate, often monthly or bimonthly, for the privilege of connection to piped water supply. When monthly charges for water consumption are not linked to the quantity consumed, households have an incentive to use the resource until their own marginal benefit of water consumption is driven to zero (Olmstead and Stavins, 2007, pp. 17). In other words, there is no incentive for conserving the water with fixed rate and generally encourage waste of water (Herrington, 2007, pp. 12; Hoque and Wichelns, 2013, pp. 482).

There are varieties of volumetric charge. First, uniform rate is the simplest structure of the volumetric charge. In this case, households are charged the same price at all levels of consumption. The average uniform rate can be set equal to the required revenue for the utility. The more sophisticated type of volumetric tariff structure is the block tariff. Increasing block tariff (IBT) structures charge higher marginal prices for higher quantities consumed, resembling a staircase ascending from left to right. Whereas, decreasing block tariff structures descends a staircase from left to right (Olmstead and Stavins, 2007, pp. 17). The IBT have been the most common tariff structure in many countries including the both industrialized and developing countries as it enables water utilities to establish a very low price for the volume of water required for subsistence, while charging much higher prices for water deliveries in excess of minimal requirements (Whichelns, 2013, pp. 311, Blanc, 2008, pp. 11, Whittington, 1992, pp. 75, Komives et al., 2005. pp. 23). Decreasing block tariffs have been used by communities in the industrialized countries in an effort to attract large manufacturing industries (Olmstead and Stavins, 2007, pp. 17).

There are some debates for the IBT design. Whittington (1992, pp. 84), by referring to the case in Ghana, argued that the IBT is not achieving its objective of helping the poor to obtain water at minimal cost. This conflicting result was due to the situation of sharing a connection in high-density housing conditions. Ironically, the poor households sharing one connection with the neighbours were charged more than the lifeline block targeted for them. Responding to this concern, McIntosh (2003, pp. 76) states that it should not be difficult to make allowances for individual families with special conditions and allow their use of water at the lower lifeline rate.

Whichelns (2013, pp. 312) and Komives et al. (2005, pp. 17) argued from the aspect of equity that IBT structures have not been successful in conveying the intended subsidies to the poor. It was pointed out that many wealthier households are also able to purchase water in the subsidized price. The different price elasticity of demand between the affluent and poor households suggests that the same proportional increase in water price will effect largely as a burden on poor households (Whichelns, 2013, pp. 317).

Another argument is the large size of the first and second blocks and low marginal prices for those blocks in IBT. Whittington (2003, pp. 65) compared the six large cities in South Asia (Chennai, Bangalore, Hyderabad, Kathmandu, Colombo and Dhaka), which use IBT and found that the resulting monthly water bills in the first two blocks are very low due to the large blocks sizes and low marginal prices. Raghpati and Foster (2002, pp. 3) examined 34 metropolitan cities and smaller cities in India, which use IBT, and pointed out that only the highest blocks used in Chennai and Bangalore were close to recovering costs for operation and maintenance of their water services. However, only small fraction of consumers was metered in Chennai, and tariffs only climb into the cost recovery range for the block more than 50 cubic metres per month in Bangalore. Whittington (2003, pp. 70) and McIntosh (2003, pp. 76) suggested that the size of the first block should be up to 5 to 6 cubic metres per month for fulfilling the basic needs and the second block should be up to 20 cubic metres as a rate to recover all financial costs.

There are other types of volumetric tariff structure such as Volume differentiated tariff (VDT) and Two-Part tariff. VDT does not subsidies the consumers who exceed the blocks. For instance, for the customers consuming less than the upper limit of the first block, their bills will be calculated on the basis of the first price, whereas, for the customers consuming more than the first block, the price for the higher block will be charged for all the water consumption (Komives, 2005, pp. 93-95; Wichelns, 2013, pp. 319). Two-Part tariff is composed of 1) a variable charge reflecting the marginal costs of providing an additional cubic metre of water for utility and 2) a fixed charge intended to cover the unattributable portion of the costs that is independent of the quality consumed (Whittington, 2003, pp. 70; Blanc, 2008, pp. 6). However, in practice, the fixed charge might be too large considering the affordability of the poor households. There are also some other innovative tariff structures that were recommended in the existing literatures (Blanc, 2008, pp.6; Wichelns, 2013, pp. 319).

In any case, discussions were predominantly about the volumetric tariff structures. In order to enforce the volumetric tariff, metering of the water consumption is a prerequisite condition.

2.6. Process of Introducing the Volumetric Tariff

What would be the key drivers for introduction of volumetric tariff? **Box 2-2** shows the common drivers for change in the urban water supply sector. The drivers for change are mostly attributing to the external environment of the urban water utilities. The political and social drivers are the particular change motivators in the developing countries. The change could be triggered by the governmental reform programmes such as New Public Management reforms and reforms imposed by donor societies.

Box 2-2: Drivers for change in the urban water supply sector

Political drivers: government legislation, government ideology (e.g. free water vs. cost recovery, water for all) and regulation

Economic and public management drivers: government policies, lending and donor policies, and changes from public to private ownership, local economy, willingness and ability to pay

Socio-cultural drivers: customer base (increase in poor customers), skill availability, concern for the environment, business and society ethics (water as a social vs. economic good)

Technological drivers: introduction of computers, generation of appropriate and demand driven water supply technology options, computerization of processes (billing, mapping) and mobile phone technology

Source: Sansom et al. (2013, pp. 10.5)

If the change is not managed properly, the situation could become worse than before. In Phnom Penh, stepwise approach was taken to introduce the volumetric water tariff as shown in **Box 2-3**. This approach accommodates the three golden rules for increasing tariffs such as: 1) tariffs may be increased gradually every month until the goals are reached; 2) make sure that service improvements, in terms of 24 hours coverage or reduced non-revenue water, parallel tariff increases; and 3) public education and awareness are very important (McIntosh, 2003, pp. 81).

Box 2-3: Steps taken to improve the water supply services in Phnom Penh

Step 1: Installation of meters for all connections

Step 2: Improvement in water quality

Step 3: Introduction of inspection teams to stop illegal connections with incentives for those providing information and the dismissal of staff found to be involved in illegal activities

Step 4: Improved customer files and information about customer demand with an eventual computerized system

Step 5 :Implementation of a programme for public awareness and education for the payment of water bills, targeted at the powerful families, government officials and even the families of the utility's own managers

Step 6: Increasing of the water tariff in 3 steps over 7 years

Step 7: Rehabilitation of the entire water network

Source: Sansom et al. (2013, pp. 10.15)

The first step for introducing the volumetric tariff is installation of meters to all the connections. The main procedures required for the meter installation programme summarized by Buenfil (1992, pp. 68-71) is shown in **Box 2-4**. In addition to the procedures, Vairavamoorthy and Mansoor (2006, pp. 202) suggested to conduct questionnaires and programme for metering pilot areas before undertaking any new metering programmes, because they will contribute to: assess consumer cooperation for installation and behaviour with a new charging system; evaluate and classify sources of difficulty and find installation techniques suitable for different cases (inside the house, external); assess problems and solutions about reading, inspection and repair; and assess the unit costs and techniques for each task.

Box 2-4: Procedures for meter installation programme

- ***Legal and Contractual Adjustment*** – Bylaw or other legal framework and contractual framework to be modified and enforced for metering and tariff structure.
- ***Funding*** – Financial sources to implement the meter installation programme.
- ***Installation Plan*** – Plan for installation of meters including: number of houses and meters, specification of meters and their installation, responsible authorities and contractors, schedules for installation and start metering, public relation strategy, etc.
- ***Meters*** – Meters and accessories procured from the suppliers.
- ***Training*** – Training for installation of meters and their operation and maintenance. Knowledge, skills and ability to deal with customers shall be trained.
- ***Maps of zones and houses to meter*** – Maps of the zones and houses to meter with names of streets and other information and directories of customers.
- ***Drawings and support material*** – Specification for meters, installation layouts and other support materials
- ***Formats, directories, and information flows*** – Basic formats for directories and information flow after installation of meters.
- ***Public relation and information to the customers*** – Provision of information to the customers by written form and other forms. Information on metering, meter installation, new tariff and starting date, how billing and payment will be, meter reading, etc. need to be provided to the customers and agreed in advance.
- ***Coordination and starting of metering*** – Good coordination with internal administration and customers is required to carry out the critical activities on time.

Source: Adopted by Buenfil (1992, pp. 68-71)

2.7. Determinants of Water Consumption

As discussed in the previous section, price is one of the major determinants of water consumption. Other major determinants of water consumption in developing countries suggested by existing literatures were: access and cost of water collection; quality of water services; and household socio-economic characteristics (Nauges and Whittington, 2009, pp. 265; ADB, 1999, pp. 48). Some of the literatures also suggested that the seasonal climatic change would also affect the water consumption (Chesnutt et al., 1997, pp. 8-8). The details of those determinants are discussed in the following sections.

- ***Access and cost of water collection***

Access and cost of water collection from the source are the important determinants in the situation of developing countries as it is common practice to collect water from more than one source. If water from other sources is readily available in good quality and price, then households will be less interested to use the water from the utility. For example, if the household has their own shallow well in good quality within their compound, they might be reluctant to connect to the piped water supply.

The water from different sources might be used for different purposes, because people may require clear water only for the purposes such as drinking and cooking for instance. According to the studies that researched the micro-components of water consumption in the industrialized countries, there are significant differences in water consumption among the individual water uses such as drinking, cooking, dish washing, laundry, bathing and toilet (Memon and Butler, 2006, pp. 8-9). In this sense, allocation of water from the alternative source would also be a determinant for water consumption. Nauges and Whittington (2009, pp. 273 and 288) stated that the determinant of how total water consumption is allocated among different uses is unknown area and analysis of household allocation of water among various uses would be a first step for clarification.

- ***Quality of water services***

If water is served uniformly to the customers in a fully satisfactory level, quality of water services would not be a determinant of water consumption. However, quality of water services often varies in developing countries among customers. For example, in case of intermittent water supply, water pressure and service hours would be different among the customers. These situations may affect the choice of water sources and also the water consumption.

According to Nauges and Whittington (2009, pp. 284), the determinants for service levels should be considered in household water demand functions for developing countries. These include opinion variables about the taste, smell and colour of the water, the service hours and the water pressure from the tap. However, generally, the variables measuring household opinion about water quality are not found to be significant in household demand function. If the water sources used in the area can be generalized, the average opinion can be investigated rather than collecting from the individual households.

- ***Household socioeconomic characteristics***

Water consumption is found to be sensitive to household size, income, education level and household composition in the existing studies.

Larger households are found to have greater water use when the household water consumption is used as a dependent variable whereas per capita water consumption decreases when the individual water consumption is used as a dependent variable.

Income level is a significant determinant in the situation where water consumptions vary significantly depending on economic wellbeing of the community. Higher income households tend to have large house and more appliances that use water, and in general they are more affordable to pay for water than lower income households.

Regarding the education level, literacy of the head of household was found to be positively associated with household choice of improved water source in the rural settings. In the urban settings, Olmstead and Stavins (2007, pp. 7) pointed out that education programme on water price and consumption information on water bills may increase the customers' price responsiveness. Providing more information to the customers may boost the impact of price increases.

Some literatures discovered that household compositions such as number of women in the household or the case of which the household head is a widow, affect the water consumption (Mu et al., 1990, pp. 528; Briand et al, 2009, pp. 118). However, those studies were targeting the rural settings and the evidences were still limited for generalizing the findings. In addition, the review of the literatures in Europe and USA suggested that households with children and young people use more water than the other households (Jeffrey and Gearey, 2006, pp. 308-309).

- ***Seasonal climatic changes***

Water consumption can change in any given year due to climatic fluctuations. Water consumption in hot and dry months is generally higher than that of cool and wet months. Especially if the households are using alternative sources, it is likely that water quantity and quality of the alternative sources changes. These conditions may affect the household choice of water sources. In the case of Cape Town, South Africa, temperature was significantly affecting the household water consumption (Jansen and Schulz, 2006, pp. 605).

In summary, the main determinants of water consumption in developing countries, especially in the urban settings are: access and cost of alternative water sources, service levels, household characteristics (household size, income levels, household composition) and climate conditions. Considering the tariff change, knowledge of the tariff structure may also increase the responsiveness of the users. These determinants were used in many studies as independent variables for estimation of the water consumption. In the next section, these literatures on water consumption analysis were reviewed.

2.8. Water Consumption Analysis

There are various studies focusing on water consumption. The aims of these studies are often to provide the policy makers with a better understanding of the degree to which price changes will affect water consumption for consideration of revising the pricing policies that could generate more revenue or conserve water (Dharmaratna and Hariss, 2012, pp. 2283; Arbues et al., 2003, pp. 97; Briand et al, 2009, pp. 107; Cheesman et al., 2008, pp. 8; Jansen and Schulz, 2006, pp. 606; Espineira and Nauges, 2004, pp. 1702; Nauges and Berg, 2008, pp. 543; Strand and Walker, 2005, pp. 314; Worthington and Hoffman, 2008, pp. 844). The statement of Espey et al. (1997, pp. 1374) who conducted the meta-analysis on price elasticity of residential water demand, well describes the drivers of these studies, “The more accurate the estimate of the demand for water, the more efficient policy makers can be in designing policy to influence water use.”

Majority of the studies were estimating the future water demand and price elasticity of demand. Despite the abundant literatures on water consumption and tariff structures, literatures that studied the effects of tariff structures on water consumption are in short (Olmstead, 2003, pp. 1; Oliver, 2010, pp. 564; Herrington, 2007, pp. 18-19; Qdais and Nassay, 2001, pp. 207). When it comes to the effects of the introduction of metering or volumetric tariff in the low-income countries, there were almost no studies available. According to ADB (1999, pp. 63), it

is actually very difficult to accurately estimate the effects of tariff on individual households. It was recommended to examine the data on earlier price increases and subsequent changes in water consumption, if available.

The underlying issue about estimating the effects of metering and tariff structure changes is that when the changes are taking place, it is likely that there are other factors at work that may also affect household water usage behaviour. For example, if one city was not metered in certain year and then comprehensively metered after five years, it is not good enough just to compare the water consumption in those two chronological dimensions. In addition, if the price changes together with the improvement of water supply services, as the typical case in developing countries, it may cause a shift from one demand curve to a new demand curve (ADB, 1999, pp. 62). To analyse the pure metering effect, one needs to think about the question: what would have been the unmetered consumption after five years, if the metering had not taken place (Herrington, 2007, pp. 18).

There are four approaches in principle to estimate the demand effects. First, ***time series analysis*** looks essentially at before and after differences with regard to the “event” of the first metering, of a tariff structure change or of a price increase, by trying to take account of what would have happened to demand had the “event” not occurred. Second, ***cross-sectional analysis*** compares the consumptions of a metered household group with those of a similar control group, with any other known factors causing the two groups to have different consumptions allowed for. Third, ***trial and control area analysis*** combines the time series analysis and cross-sectional techniques. Forth, ***panel data analysis*** tends to be used to describe the complex analysis of consumption of many individual households both chronologically and across households (Herrington, 2007, pp. 18).

Comparing the ***cross-sectional analysis*** and ***panel data analysis***, latter is preferable for analysing the causal effect of the determinants. In general, it is often difficult to confidently ascribe a causal relationship of the independent variables to the dependent variables on the basis of cross-sectional analysis as many of the independent variables are arguably endogenous, and good instruments for these are rarely available. By using the panel data, variation is little in potentially important covariates such as water quality and reliability. Nevertheless, most of the researchers estimate household water demand in developing countries, used data from cross-sectional household surveys (Nauges and Whittington, 2009, pp. 269, 274).

In order to conduct an analysis on water consumption, a researcher needs to collect data for dependent variables (water consumption) and independent variables (determinants). When collecting the water consumption data, if water is metered at the household level, usually panel data on each household water use can be obtained. If the households are unmetered,

households themselves usually have little idea how much water they consume and therefore, direct interviews with them will be of no use in determining accurate quantity. In this scenario, the suggested methods for the estimation are: 1) measuring the volume of water storage facilities available in the house; 2) carrying out a small in-depth survey among a selected number of users; 3) installation of temporary water meters at a selected number of connections; 4) calculating the number of containers of water which are hauled by a household from each supply source; and 5) estimating the average household water consumption by using a bulk meter if available (ADB, 1999, pp. 60). The main option would be installing meters to the customer but it may change the behaviour of the users (Nauges and Whittington, 2009, pp. 273). Other than the previous methods, Memon and Butler (2006, pp. 15-16) introduced a method used in UK for estimation of unmetered consumption called micro-component analysis. In this analysis, the information on ownership level, frequency of use and quantity of water consumed for each water using appliance is multiplied and summed up to calculate the per capita consumption of the unmeasured households. This method might not be relevant to provide an accurate estimate under the complicated water usage in developing countries and it also requires a considerable amount of resources to gather the data on appliance characteristics such as ownership, frequency of use and volume of water per use.

For collecting the data for independent variables, it is preferable to conduct a well-designed household survey. Household surveys often gather a large amount of information on socioeconomic and demographic characteristics. One of the important variables in the water demand study is income of the household. Due to its sensitive nature of asking income of the household, researchers attempt to use other variables as proxies such as appearance of houses and asset ownerships. Using the household expenditures is one way of considering the household income levels, as households are more likely to understate their incomes than to overstate their expenditures (Nauges and Whittington, 2009, pp. 277). Asking expenditures for electricity bill is one of the common ways of estimating the household income. This method can be justified by the monthly residential electricity expenditure patterns compared with the household incomes as shown in **Figure 2-6**. The graph indicates that households with higher income are paying more expenditure for electricity and the amount of electricity consumed is significantly increasing, especially in low-income countries.

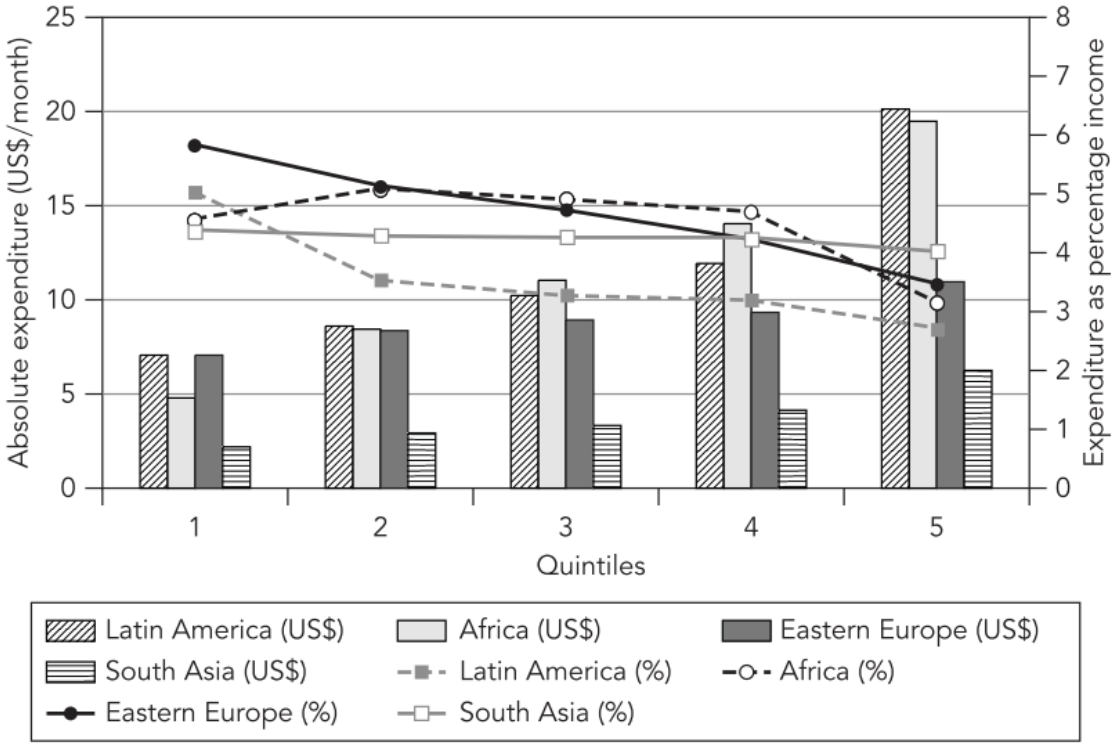


Figure 2-6: Monthly residential electricity expenditure patterns by region

(Source: Komives et al., 2005, pp. 41)

Nauges and Whittington (2009, pp. 288) made some recommendations for the data collection through household survey. The recommendations related to piped water supply are as shown in **Box 2-5**. For this research the third, fourth and sixth recommendations were applicable. The first recommendation was not suitable for case study for single area. The second recommendation can be used for justifying the results of change in household source choices but the information could be collected by different research techniques such as observation. The fifth recommendation was not suitable as the aim of research was not to forecast the demand.

Box 2-5: Issues when designing a household survey on water usage

1. Areal coverage of household survey: Surveys should ideally be made in more than a single city or village, in order to acquire data with cross-sectional variation regarding conditions of water services, in particular price, connection fee, and quality and reliability of services.

***2. Data collection on other available water sources*:** In most cases only data on sources that are actually used by the surveyed household are available. Ideally one should identify the complete set of sources available to the household (whether used or not) and gather information on the time to walk from home to any off-site source(s) used or not used, the waiting (queuing) time at the source(s), price of the water, possible rationing or constraints (opening hours, limited availability), and quality of the water from each source (whether used or not). These considerations are a prerequisite for consistent estimation of household choice of water sources.

***3. Test the knowledge of the respondent*:** At the time of the survey, interviewers should test each household about its knowledge of consumption and water expenditure during the last piped water billing period and of the pricing scheme.

***4. Control the seasonal effect on water demand*:** It may be important to control for demand seasonality, because demand (in total and for water by source) may vary over the course of a year.

***5. Permanent and non-permanent household members*:** For planning it may also be important to control for number of permanent and non-permanent household members.

***6. Endogeneity of water infrastructure*:** To determine whether water infrastructure (storage tank, pumping equipment) is endogenous, that is, whether current household water usage might be linked to the acquisition of new infrastructure, installation dates can be recorded to serve as a measure of how recently these were purchased.

Source: Nauges and Whittington (2009, pp. 288)

There were very few studies that have studied about the impacts of fixed rate tariff to volumetric tariff. Most of the studies had taken place in UK (Herrington, 2007, pp. 18-22). The before and after comparison of water consumption of 300 households carried out in 1970 suggested an 11% reduction in the overall average use. The case suggested that if the households had remained unmetered, an average of 14-15% effect at most. In 1976, the cross-sectional analysis compared the 1000 households each in Malvern and Mansfield, with many regressions, a mean difference of 12.5% was resulted. Then during 1989-1991, over 50,000 properties in Isle of Wight were completely metered and 21% of reduction in demand was carefully estimated. Analysis of the small-scale metering trials from eleven sites covering

three to four years suggested the average impact effects of 12.0-12.5%. This reduction of 12.5% is still quoted today as the likely effect of household metering.

The only study conducted outside of the European countries was the study in Abu Dhabi City in 1996-1997 (Qdais and Nassay, 2001, pp. 207-214). The water consumption data of randomly selected 90 households were compared and presented a result of 29% reduction. In this research, water consumption before introduction of volumetric tariff was collected by metering with the hypothesis that consumers were not informed about the month of starting the metering. The amount of reduction was high comparing to the results in UK. One of the reasons of the high reduction might be high consumption of the households, which average was 590 litres per capita per day.

The other researches on water consumption were dominantly about the demand estimation and/or household source choice and their determinants by applying the sophisticated econometric analysis. The main challenges for those econometric modeling were to avoid simultaneity and modeling the demand discontinuity caused by non-linear block tariffs (Arbues et al., 2003, pp. 92-96; Nauges and Whittington, 2009, pp. 269). When it comes to a demand estimation in developing countries, the models employed in those studies can be classified into mainly three categories such as: 1) estimation of demand for water coming from one particular source; 2) Discrete analysis of source choice; and 3) combination of source choice model and model of water use conditional upon source choice (Nauges and Whittington, 2009, pp. 271). The probit model and the multinomial logit model were used mainly for modeling the household choice models.

2.9. Chapter Conclusion

In summary, water pricing including the introduction of volumetric tariff is a strong instrument to break the vicious circle of water service decline in developing countries. In other words, water pricing will provide impacts to various areas in water supply services. Although there is a common understanding of the importance of water pricing reform, tariff design is a controversial area, which needs a careful investigation to achieve the main objectives such as revenue sufficiency, economic efficiency, equity and poverty alleviation. Installation of meters is a prerequisite condition for introducing volumetric tariff and it should be managed strategically, otherwise it could lead to a worse situation than before.

Investigating relationship between water consumption and tariff is a classic research topic and thus there are ample literatures available. The empirical evidences suggest that main potential determinants of water consumption in developing countries are: accessibility and cost of alternative sources, quality of water supply services, socioeconomic conditions, climate and

price of water. However, surprisingly, there are no studies that revealed an empirical effect on water consumption of changes from fixed tariff to volumetric tariff in the low-income countries. Clarifying the effect of volumetric tariff on water consumption would be beneficial for water utilities to design the volumetric tariff structure that could attain the targeted objectives of pricing reform.

From the result of the literature review, the findings were compared with the situation of ZAWA and list of required data was prepared as **Table 2-3**. In the next chapter, how to collect and analyse these data were described.

Table 2-3: Data required for answering the research questions

1. What was the water service situation of ZAWA before the introduction of volumetric tariff?
• Institutional set-up • Organizational status • Human and financial resources • Water supply situation • Cost recovery • Mission, visions and goals
2. What was the process of introducing the volumetric tariff?
• Drivers for introducing volumetric tariff • Legal adjustment • Process of designing a tariff • Meter installation plan • Human and financial resources for introducing the volumetric tariff • Public relation and information to the customers
3. What were the effects of volumetric tariff on residential water consumption?
• Water consumption before and after the introduction of volumetric tariff • Water usage • Accessibility and cost of alternative water sources • Service hours • Water pressure • Number of household members • Income level • Household composition • Awareness on the month of tariff change • Climate

Chapter 3. Methodology

This chapter describes the methodological approach and research design employed in the research and clarified the procedure for answering the research questions. In detail, section 3.1 explains the background of employing the case study approach. Section 3.2 describes the framework of case study and data collection techniques employed in the framework. It also presents the outlines of the collected data. Section 3.3 explains the data analysis procedures for the quantitative analysis used for answering the third research question. Section 3.4 contains the reliability and validity procedures for the data collection. Section 3.5 describes the ethical consideration taken in the fieldwork. The chapter was concluded in section 3.6 by summarizing the collected data in correspondence with the research questions.

3.1. Methodological Approaches

Conventionally, there are two methodological approaches for research: quantitative and qualitative. ***Quantitative approach*** is based on a philosophy of positivism and the researcher tests a theory by specifying narrow hypotheses and the collection of data to support or refute the hypotheses. ***Qualitative approach*** is based on a philosophy of constructivism and the researcher seeks to establish the meaning of a phenomenon from the views of participants (Creswell, 2009, pp. 16). The relatively new approach is the mixed methods approach. ***Mixed methods approach*** is based on a philosophy of pragmatism and the researcher combines qualitative and quantitative approaches within a single research project (Creswell, 2009, pp. 10; Denscombe, 2007, pp. 107).

Case study approach is another methodological approach used in social research (Yin, 2009, pp. 4; Denscombe, 2007, pp. 35-36). According to Yin, a case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries phenomenon and context are not clearly evident. The use of case study is appropriate, when the researcher wants to understand a real-life phenomenon in depth, but such understanding encompassed important contextual conditions – because they were highly pertinent to that phenomenon of study.

Creswell (2009, pp. 13) introduced case study as one of the strategy of qualitative approach while Yin (2009, pp. 4) stated that case study could go beyond being a type of qualitative research, by mixing quantitative and qualitative evidence. Denscombe (2007, pp. 37) did not clarify the relation with quantitative and qualitative approaches, however, states that the

strength of the case study approach is that it allows for the use of a variety of methods depending on the circumstances and the specific needs of the situation. There are some similarity between the case study approach and mixed methods approach. Yin (2009, pp. 63) stated that some kinds of case studies represent a form of mixed methods approach.

In this research topic, application of the case study approach was relevant for the following three reasons. First, water supply situations differ from place to place and it requires broader contextual information to understand the real-life situation of the water users. Second, one of the research questions was to investigate the effects on water consumption and it was aiming to find out the changes in water consumption as well as its factors. The real value of a case study is that it offers the opportunity to explain why certain outcomes might happen – more than just find out what those outcomes are (Denscombe, 2007, pp. 36). Third, the ample literatures adopting the case study approach for water demand analysis could also justify its appropriateness of adopting the case study approach.

3.2. Research Design

A research design is the logic that links the data to be collected to the initial questions of study. In this section, a research design to answer the research questions is described.

- ***Units of Analysis in the Case Study***

Case studies can be classified into ***embedded case study*** and ***holistic case study*** (Yin, 2009, pp. 50). The embedded case study gives an attention to a subunit or subunits of analysis within a single case, whereas, holistic case study examines only the global nature of an organization or of a program.

This research was designed as single embedded case study as shown in **Figure 3-1**. This research targeted the single-case of volumetric water pricing by ZAWA and examined two subunits of analysis: ZAWA and metered residential water customers in Makadara Shehia. Shehia is a lower tier under the district administration in the government structure of Zanzibar. There are 45 Shehias in the Urban District of Zanzibar. Out of these 45 Shehias, Makadara and Gulioni were the two Shehias which had relatively high water pressure from the adjacent elevated tanks located at Saatini Station, and Makadara was the only Shehia that introduced the volumetric tariff from 2010. The location and demographic features of Makadara are shown in **Figure 3-2** and **Table 3-1**, respectively.

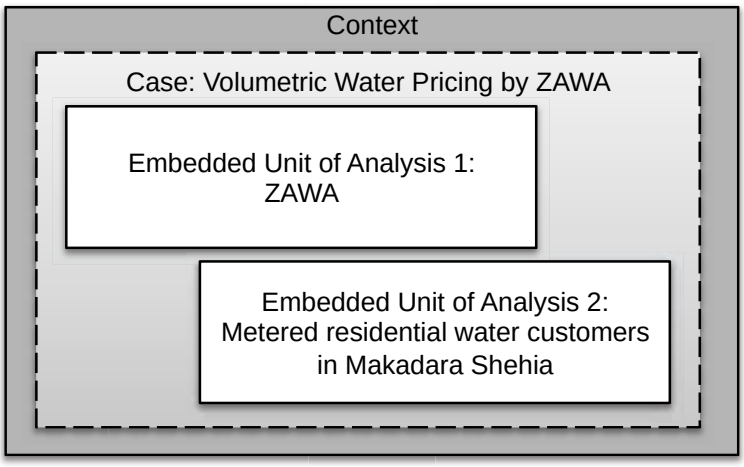


Figure 3-1: Units of analysis in the case study

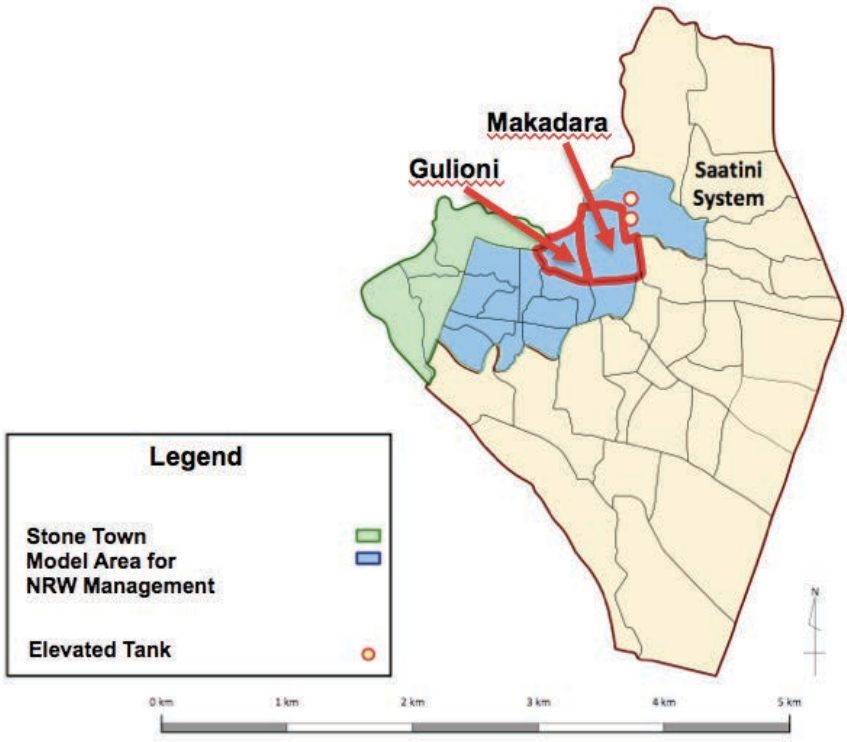


Figure 3-2: Location of Makadara Shehia
(Source: JICA, 2014)

Table 3-1: Population, number of households and domestic customers in Makadara (2012)

Population	Number of households	Number of domestic customers	Service coverage rate
5,048	952	764	80 %

Source: United Republic of Tanzania (2013) and JICA (2012)

The case was chosen deliberately on the specific attributes to be found from the case. As mentioned earlier, transitions from “free water” policy to “water pricing” policy as well as “no-metering” to “metering” policy are the likely trends that would happen in the water utilities in developing countries. The case would be intrinsically interesting as the ZAWA’s experience could be transferred to other water utilities. In addition, ZAWA is under the process of expanding the water metering in the Urban District of Zanzibar. The units of analysis selected in this research would be a representative case for the other Shehias which are going to introduce the volumetric tariff.

- ***Data Collection Techniques used in the Case Study***

The embedded case study relies on holistic data collection strategies for studying the contextual conditions but then may call upon surveys or other more quantitative techniques to collect data about the embedded unit or units of analysis (Yin, 2009, pp. 63). In this research, both quantitative and qualitative data were collected holistically to answer the determined research questions, and accordingly, a quantitative household survey was conducted. Data collection techniques used to answer the research questions are shown in **Figure 3-3**. Details of the data collection techniques are explained in the following paragraphs.

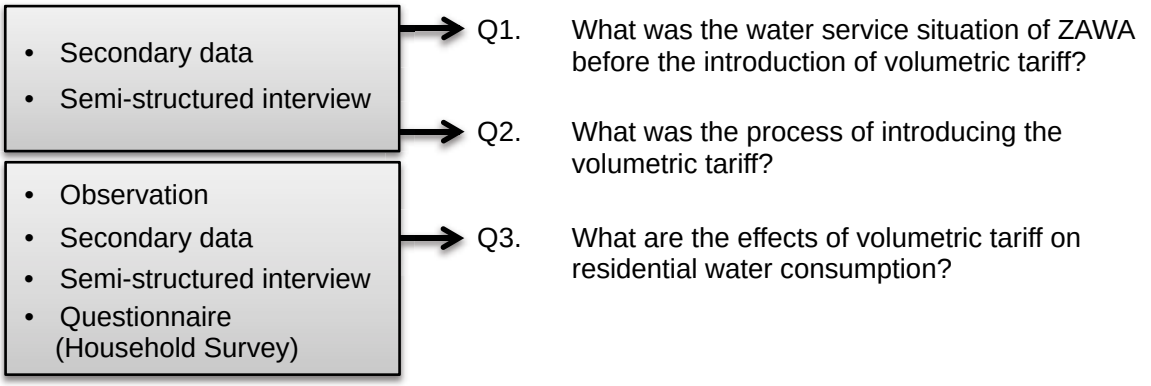


Figure 3-3: Links between the research questions and data collection techniques employed in the research

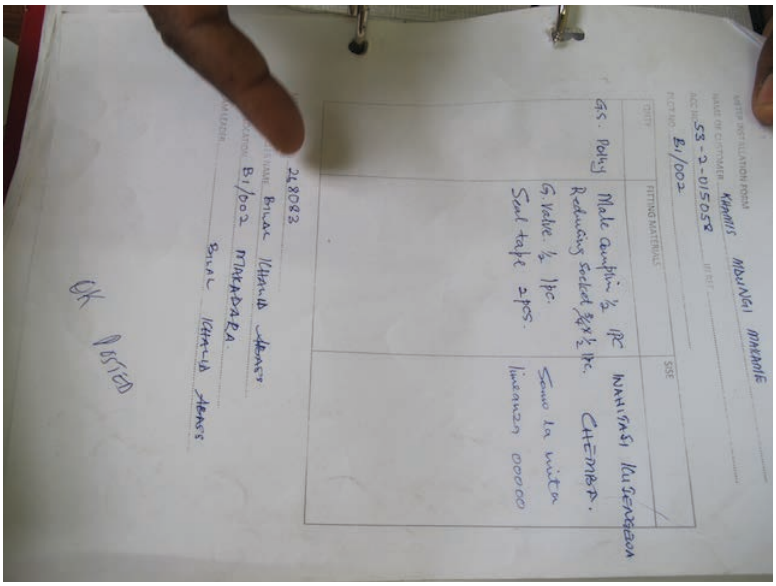
- ***Secondary Data***

Collecting secondary data is a standard practice for doing fieldwork in the developing countries, whether the researcher undertakes primarily quantitative or qualitative data collection. Even when the published data is not directly applicable, it is often useful for understanding the context of the more narrowly defined research topic. However, researcher

should beware that the data may not be necessary truthful or valid (Scheyvens and Storey, 2003, pp. 42).

The secondary data was collected for gathering the information that contributes to answer the research questions more accurately than the data collected from other techniques. For example, financial data or statistics were appropriate to be collected through the secondary data rather than collecting them from the interviews. In addition, officially published documents such as legal documents and policy papers were useful for validating the data collected from the interviews and understanding the broader context of the research topic. Project documents from donor agencies were also useful to understand the background and contents of development activities conducted. Metered water consumption data was essential for the quantitative analysis employed in the research.

The checklist of the required secondary data was prepared before departing to the fieldwork (**Appendix 1**). Some of the data were available from the websites of the government or donor agencies. The data were obtained in the form of paper or data. In some cases, pictures of the documents were taken for the recording purpose. The contents of data were verified with related informants, face-to-face. The list of secondary data used in this research is shown in **Table 3-2**. Each collected data was coded for the purpose of data management and referencing in the research.



Picture: Meter installation record of the first metered customer

Table 3-2: List of collected secondary data used in the research

Correspon -ding Research Question	*Required data*	*Secondary data collected*	*Code*
Institutional set-up			
Q1	• National water policy • Legal framework • Institutional capacity	• Zanzibar Vision 2020 (RGZ, 2000) • The Water Act (RGZ, 2004) • The Water Regulation (RGZ, 2006) • Preparatory Study Report on the Project for Zanzibar Urban Water Supply Development (JICA, 2002)	S1 S2 S3 S4
Organizational status			
Q1	• Organogram • Organizational performance (SWOT, KPI)	• Job Descriptions (ZAWA, 2008) • Preparatory Study Report on the Project for Enhancement of Water Supply Management of ZAWA (JICA, 2007) • Implementation Review Study Report on the Project for Zanzibar Urban Water Supply Development Phase II (JICA, 2008)	S5 S6 S7
Human and financial resources			
Q1	• Number of staff • Training programme • External and internal financial resources	• Board of Directors' Report and Financial Statements (ZAWA, 2010, 2011, 2012, 2013) • Final Report of the Technical Cooperation Project for Enhancement of Water Supply Management of ZAWA (JICA, 2010)	S8 S9
Water supply situation			
Q1	• Water resources • Infrastructure • Service levels	• Joint Mid-term Evaluation Report of the Project for Enhancement of Water Supply Management of ZAWA (JICA and ZAWA, 2009) • Draft Basic Rolling Plan on NRW Reduction (ZAWA, 2014) • Basic Design Study Report on the Project for Zanzibar Urban Water Supply Development (JICA, 2005)	S10 S11 S12
Cost recovery			
Q1	• Operation and maintenance cost • Service revenue • Investment plan	• Board of Directors' Report and Financial Statements (ZAWA, 2010, 2011, 2012, 2013) • Strategic Business Plan July 2008 – June 2013(ZAWA, 2008)	S8 S13
Mission, visions and goals			
Q1	• Mission, vision and goals • Action plan	• Strategic Business Plan July 2008 – June 2013(ZAWA, 2008) • Review and Update of Strategic Business Plan for the period of 2013 – 2018 (NIRAS, 2013)	S13 S14
Drivers for introducing volumetric tariff			
Q2	• Archival documents • Local news, etc.	• Preparatory Study Report on the Project for Zanzibar Urban Water Supply Development (JICA, 2002)	S4
Legal adjustment			
Q2	• Legal document (bill for the government gazette)	• The Water Regulation (RGZ, 2006)	S3

Process of designing a tariff			
Q2	• Archival documents for tariff design, etc.	• Final Report of the Technical Cooperation Project for Enhancement of Water Supply Management of ZAWA (JICA, 2010)	S9
Meter installation plan			
Q2	• Schedule • Number of meters and specifications • Maps • Supporting materials for installation • Directories for meters and metered customers • Information flow • Actual implementation schedule	• Final Report of the Technical Cooperation Project for Enhancement of Water Supply Management of ZAWA (JICA, 2010) • Meter Installation Record (ZAWA, 2010 - 2014) • Smart Billing Manager 1 (customer database) (ZAWA, 2010 - 2013)	S9 S15 S16
Human and financial resources for introducing volumetric tariff			
Q2	• Training programme and modules • Participation list • Financial document for purchasing meters, etc.	• Final Report of the Technical Cooperation Project for Enhancement of Water Supply Management of ZAWA (JICA, 2010)	S9
Public relation and information to the customers			
Q2	• Public relation materials and tools	• Final Report of the Technical Cooperation Project for Enhancement of Water Supply Management of ZAWA (JICA, 2010)	S9
Metered water consumption data			
Q3	• Meter reading data of Makadara	• Smart Billing Manager 1 (Customer database) (ZAWA, 2010 - 2013) • Smart Billing Manager 2 (Customer database) (ZAWA, 2013-2014)	S16 S17
Climatic data			
Q3	• Temperature • Rainfall	• Monthly rainfall and temperature data (Meteorological Agency, 1995 - 2005)	S18

- ***Semi-structured Interview***

Semi-structured interviews were employed in the research. Semi-structured interview has a clear list of issues to be addressed and questions to be answered, yet more flexible than the structured interviews. It has an advantage to let the interviewee develop ideas and speak more widely on the issues raised by the researcher (Denscombe, 2007, pp. 176). In this sense, structured technique was appropriate for collecting factual information, whereas, semi-structural technique was appropriate for shedding light on undocumented facts and hindering backgrounds.

The purpose of interview was to collect the information on water service situations before the introduction of volumetric tariff and the process of commencing the volumetric charging. In addition, questions related to ZAWA's policy on water pricing and metering, and the identifiable impacts caused by them were interviewed. The latter questions were not directly

linked with the research aim and questions, however, they were important for understanding the wider context of the research scope and to discuss the analytical results coming out from the study.

The interview guides were prepared before each interview (**Appendix 2**). All the interviews were recorded with recording device and transcribed. Before recording, consent for recording the interview was obtained from every informant. The conducted interview and their date and informants are listed in **Table 3-3**. Transcription of the interview is attached as **Appendix 3**. Each interview was coded for the purpose of referencing in the research.

Table 3-3: List of interview data

Date	*Contents of the data*	*Informants*	*Code*
26th May 2014	• Water service situations before and after the introduction of volumetric tariff • Situations and changes in the external environment • Driver for water pricing • Plan for meter installation • Public relation activities for introducing the volumetric tariff	Mr. Rashid Juma Khamis Chief Credit Control	I1
26th May 2014	• Chronological history of introducing the volumetric tariff	Mr. Mussa Ramadhan Haji Director Customer Services	I2
27th May 2014	• Water service situations before and after the introduction of volumetric tariff • Situations and changes of external and internal environment of ZAWA • Driver for water pricing • Public relation activities for introducing the volumetric tariff	Mr. Mussa Ramadhan Haji Director Customer Services	I3
28th May 2014	• Organogram • Number of staff • Training programme	Mr. Hassan Juma Ali Chief Human Resources	I4
28th May 2014	• Installation of water meters	Mr. Abdul Bari Kai Haji Mr. Bilal Khalid Abass Assistant Technician	I5
30th May 2014	• Public relation activities before the installation of the meters	Mr. Hakim Ali Foum Chief Monitoring and Evaluation (Previously working as a public relation officer)	I6

- ***Observation***

Observations are one of the most crucial tools for researchers, whether they result in the generation of ‘hard data’ or merely impressions and surprises which help the way we shape and interpret our research (Scheyvens and Storey, 2003, pp. 39). Observations draw on the

direct evidence of the eye to witness events first hand. Observations should be carried out systematically in order to avoid the researcher's psychological effect (Denscombe, 2007, pp. 207-209).

The purpose of conducting observations was for triangulation with the questionnaire data by directly observing the water usage of the households. For example, sharing of the house connection and usage of the public sources were observed to understand the situation of the households. It was also used to finalize the questionnaire format by adjusting the questions to the actual situation.

Observation was conducted during the time when the water was available from the taps. Maps and observation schedules were prepared in advance. The route for observation was selected on the map and walked with same pace throughout the observations. Observation was accompanied by two bill attendants in the area. Types of public water facilities, types of water usages, characteristics of the users and their frequency of appearance were recorded in the observation schedule (**Appendix 4**).

Picture: Observational was conducted with two bill attendants

- ***Questionnaire***

Questionnaires are the most common means for collecting quantitative data (Scheyvens and Storey, 2003, pp. 39). Questionnaires are appropriate to use when the research requires a standardized data from the large numbers of respondents in many locations (Denscombe, 2007, pp. 154).

The purpose of the questionnaire was to collect the household data in order to examine the determinants of residential water consumption by analyzing the relationships between dependent variable and independent variables. Before designing the questionnaire, those dependent and independent variables had to be determined.

There were potentially two ways of investigating the effects of volumetric tariff on water consumption. The first way was to use the panel data of metered customers to compare the before and after situations of introduction of volumetric tariff. In this case, the first meter reading data for each customer would be regarded as the water consumption data demonstrating the situation before the introduction of volumetric tariff, and compared with the water consumption data after the certain period from the introduction of volumetric tariff. Another way was to use the cross-sectional data between the two areas including metered and unmetered areas to compare the on and off situations.

Considering the advantages and disadvantages of the both options, the panel data analysis was preferable for the following reasons. First, it was difficult to estimate the water consumption of the unmetered customers by measurement of the stored water and interview from the customers. Second, it was difficult to collect the samples from different two areas under the limited resources and time for the researcher. Third, the variations of the independent variables would be larger in the cross-sectional case comparing to the panel data analysis (Nauges and Whittington, 2009, pp. 269, 274).

On the other hand, there were two potential disadvantages for the panel data analysis. First, water consumption in the first meter-reading month might be already affected by the volumetric tariff. Second, although the effect is smaller comparing to the cross-sectional analysis, there would be potential longitudinal changes in the independent variables between the time of introduction of volumetric tariff and the time of the questionnaire survey.

In order to deal with the first disadvantage, level of the people's awareness on tariff change was studied to understand the magnitude of possible effect. If the customers were not sufficiently informed about the tariff changes, the magnitude of the effect would be smaller. In the opposite situation, customers would be more sensitive to the tariff change. Information on these situations was collected by interviews and questionnaires.

As for the countermeasure of the second disadvantage, determinants of the water consumption were analysed separately from the changes of the water consumption. The determinants of water consumption were analysed by investigating the relationship between the recent water consumption and the data collected from the questionnaire, so that the analysis would not be affected by the longitudinal changes in the households.

For assessing the determinants, hypothetical structural relationship between the dependent and independent variables was designed as shown in **Figure 3-4**. The average of recent monthly water consumption data was set as a dependent variable. The selected potential determinants identified through the literature review were set as independent variables.

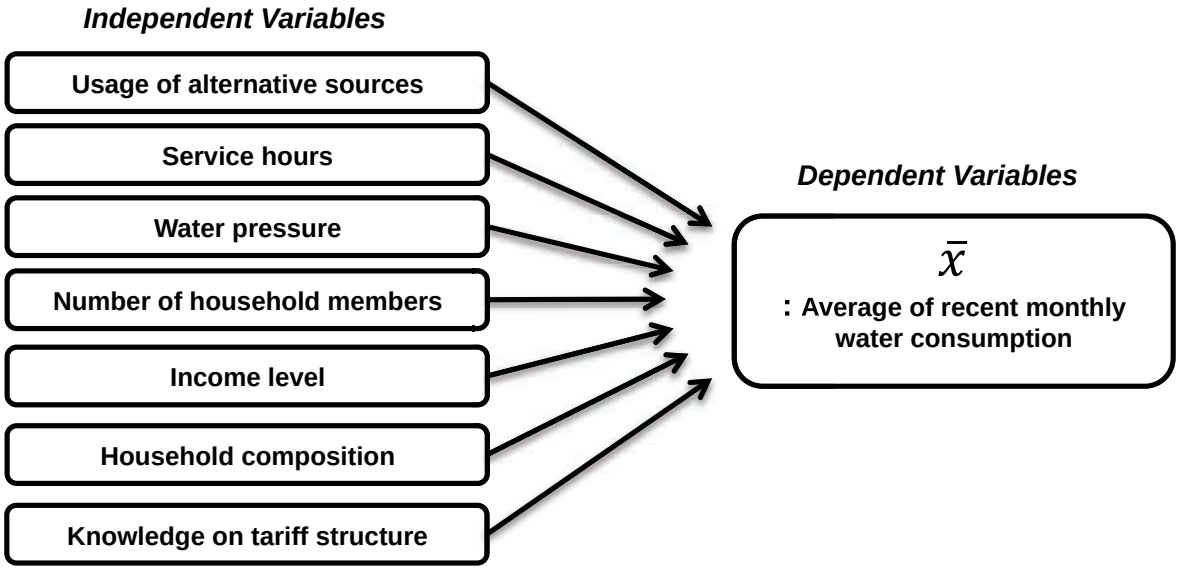


Figure 3-4: Hypothetical structural relationship between the dependent and independent variables

Based on the independent variables in the hypothetical structural relationship, only the absolutely vital questions were included in the questionnaire. The length of the questionnaire was designed as short as possible, so that the participants as well as the surveyors would not be bored in answering or administrating the questionnaires. Unsuitable questions were excluded after carrying out the observation in Makadara. For example, unnecessary types of alternative water source were excluded from the answering options. Some of the questions were included as the proxy for the sensitive questions such as monthly electricity bill for understanding the household income levels. Such sensitive questions were dealt at the end of the questionnaire format and more straightforward factual questions were asked at the beginning.

Questionnaire format was designed for the ZAWA staff to administer the questionnaire to the customers and fill in the answers directly by them, as a mail out interview is unlikely to be successful in the developing countries (Scheyvens and Storey, 2003, pp. 40). Questionnaire was translated into Swahili to ensure the reliability of the data among the surveyors by avoiding the mistranslation. The questionnaire survey was conducted by six ZAWA staff. Trainings for the surveyors were conducted twice with the pre-tested questionnaire format. Piloting of the questionnaire was conducted in Makadara after all the surveyors become

confident on the contents of the questionnaire format. Questions on the customer's knowledge on tariff were deleted after the piloting, because it was provoked that the customers do not understand the tariff structure. In addition, questions on the past situation were also deleted, as many respondents were unconfident about the situation of the time when the meter was installed. The questions asked in the final version of the questionnaire are shown in **Table 3-4**. Both English and Swahili questionnaire formats are attached as **Appendix 5** and **Appendix 6**, respectively.

Table 3-4: Questions included in the final version of questionnaire format

Code	***Question***	***Type of question***
Household Information		
Q30	Respondent's name	Open-ended
Q31	Respondent's sex	Dichotomous
Q32	Respondent's age	Interval
Q33	Home address	Open-ended
Q34	Householder's name	Open-ended
Q26	Householder's occupation	Open-ended
Q27	Number of males in the house	Interval
Q28	Number of females in the house	Interval
Q29	Number of children under 18	Interval
Water Usage		
Q1	Usage of house connection from ZAWA	Dichotomous
Q2	Usage of alternative water sources	Nominal
Q3	Order of the frequently used alternative water sources	Ordinal
Q4	Purposes of using water sources	Dichotomous
Usage of house connection		
Q5	Availability of water from the tap	Interval
Q6	Perception on water pressure	Ordinal
Q7	Usage of booster pump for house connection	Dichotomous
Q8	Year of booster pump installation	Nominal
Q9	Sharing of the house connection with neighbours	Dichotomous
Q10	Number of households sharing the house connection	Interval
Q12	Awareness of the month changed to volumetric tariff	Dichotomous
Q13	Change in water usage after the introduction of volumetric tariff	Dichotomous
Payment for alternative sources		
Q14	Payment for alternative source No.1	Dichotomous
Q15	Amount of payment for alternative source No.1	Interval
Q16	Payment for alternative source No.2	Dichotomous
Q17	Amount of payment for alternative source No.2	Interval
Q18	Payment for alternative source No.3	Dichotomous
Q19	Amount of payment for alternative source No.3	Interval
Household income		
Q20	Amount of monthly bill for electricity	Interval
Q21	Amount of monthly mobile phone bill	Interval
Q22	Household income level	Interval
Perception on ZAWA's services		
Q23	Satisfaction level on ZAWA's services	Ordinal
Q24	Request or suggestion on ZAWA's services	Open-ended

The target sample size was calculated as 198 with the confidence level of 95 percent and the width confidence interval of 6 percent within the population of 764 domestic customers in Makadara. The questionnaire survey was conducted from 2nd to 5th June, 2014 and obtained 200 samples. Stratified sampling technique was used for selecting the participants of the questionnaire. Samples were collected almost evenly from the metered customers in the main 12 distribution zones in Makadara and randomly within each distribution zone.

Customers' account numbers and plot numbers were necessary for matching the questionnaires and the water consumption data. In order to make sure those numbers are correctly written in the questionnaires, all the samples were verified by triangulating with the customer database and meter installation records.

Picture: Surveyor asking questions to the customer

3.3. Data Analysis Procedures for the Quantitative Analysis

Contextual situation of the case was examined by analysis of secondary data, semi-structured interviews and observation whereas effects on water consumption were mainly examined by quantitative data analysis carried out with water consumption data and household data collected through the questionnaires. This section describes the procedures taken in the quantitative data analysis employed in the research.

- ***Descriptive Analysis of the Households***

Characteristics of Makadara were presented by summarizing the observation result and analysing the descriptive statistics of the population targeted in the questionnaires. Univariate profiling was conducted for each data collected from the questionnaires. Central tendency and dispersion for the interval data were examined by typical statistical values such as mean, median, maximum, minimum and standard deviation. Graphical examination was also conducted by creating histograms for the interval data. Frequency of the data was examined for the categorical data.

- ***Changes in Water Consumption by introduction of volumetric tariff***

The changes in water consumption by introduction of volumetric tariff were analysed by comparing the metered household water consumption of the month which customers changed their tariff from fixed to volumetric rate, and the annual average of monthly water consumption after six months from the introduction of volumetric tariff. Example of the data is shown in **Figure 3-5**. The period of six months after the introduction of volumetric tariff was set hypothetically for the water consumption to be constant after the tariff change. Since the months of introduction of volumetric tariff varied among the households, annual average of water consumption was used in order to eliminate the seasonal effect on water consumption.

	First meter reading month				Months used for calculating the average consumption (12 months)							
Sample number	x_1	x_2	x_3	…	x_7	x_8	x_9	…	x_{16}	x_{17}	x_{18}	…
1	53	19	43	…	30	32	22	…	20	13	24	…
2	3	8	10	…	10	9	7	…	10	15	11	…
3	31	15	14	…	17	15	22	…	15	21	25	…
.	.	.	.	…	.	.	.	…	.	.	.	…
.	.	.	.	…	.	.	.	…	.	.	.	…
133	28	41	51	…	0	5	20	…	27	27	28	…
134	24	27	30	…	9	14	11	…	11	16	11	…

Figure 3-5: Example of the data used for analysis on water consumption changes by the introduction of volumetric tariff

Univariate profiling of the water consumption data was conducted and then the bivariate profiling was conducted. For the bivariate profiling, correlation between the first meter reading data and the annual average of water consumption data was analysed by calculating the Pearson's correlation coefficient and drawing a scatterplot. Pearson's correlation coefficient

was employed for the analysis because both of the variables were interval data. Pearson's correlation coefficient has an advantage comparing to the other ways of analysis using the measurement of lower level (nominal and ordinal data). The Pearson's correlation coefficient describes the extent to which an increase or decrease in one variable is accompanied by an increase or decrease in the other (Malec, 1993, pp. 217-218).

- ***Determinants of Water Consumption***

Potential determinants of water consumption were analysed in order to examine the factors that might be affected the changes in water consumption other than the introduction of volumetric tariff. Correlations between the dependent variable and independent variables were examined. Average monthly water consumption of the recent months was used as dependent variable and the data collected from the questionnaires were used as independent variables. Pearson's correlation coefficient and scatterplot was employed for the independent variables collected in interval form. Regarding the independent variables collected in nominal or ordinal forms, according to Bryman & Cramer (2001, pp. 182-184), when ordinal variables has relatively few categories and the interval variable has many values, examining the means and standard deviations of the dependent variable between the sub-group in the independent variable is more appropriate than employing the rank correlation such as Spearman's rho or Kendall's tau. Therefore, analysis of variance (ANOVA) and eta coefficient were employed for the independent variables collected in nominal or ordinal form.

- ***Data Set for the Quantitative Analysis***

Quantitative analysis was carried out based on the data set combining the questionnaire data and water consumption data. Number of the collected questionnaire samples was 200, however, one sample was unable to match with the water consumption data due to the missing account number and plot number. Therefore, 199 household water consumption data from May 2010 to April 2014 was collected from the customer database. Following five points had to be considered for finalizing the dataset.

First, it was confirmed that there were months, which households were billed for more than one month after the absence of meter readings in the previous months. The meter readers were supposed to read the meters every month. However, there were some cases that meter was not read in the certain months, and the consumption of two or more months was billed collectively in the next month. In this case, the consumption for the months without meter reading was zero and the consumption of the following month was almost double or triple. This situation was also happening in the first bill after the introduction of volumetric tariff for some of

the customers. In order to avoid this error, the first meter reading date and the first month billed based on the volumetric tariff were checked. When the household was charged for more than one month in the first bill based on the volumetric tariff, the consumption was divided by the number of the months included in the first bill.

Second, there was considerable number of missing data during the period of June and September 2013 due to updation of the customer database in June 2013 (approximately 20 missing data from each month). Ideally, the average of the recent monthly water consumption should be the annual average, so that the analysis can minimize the potential seasonal effect on water consumption. However, the researcher had to use the data of seven months from October 2013 to April 2014 for calculating the average water consumption of recent months. According to the data collected from the Meteorological Agency, four months from June to September were the dry months. Hence, there is a possibility that the average water consumption for the recent months could be relatively less than the annual average. Examining the previous year's case, average mean and median of the monthly water consumption between the period between October 2012 and April 2013 was about one cubic metre less than period of June and September 2012.

Third, apart from the period mentioned in the previous paragraph, there was also some missing data in the water consumption data. When calculating the average water consumption for both analysis on consumption changes and determinants, the cases which had more than 15 percent of missing data were deleted following the recommendation by Hair et al. (2005, pp. 56). This means if more than one missing month existed for calculating the average monthly water consumption, the case was excluded.

Forth, unusually high water consumption data were considered as outliers. Univariate methods were employed for outlier detection. According to Hair et al. (2005, pp. 75), for the sample sizes more than 80 samples, outliers are typically defined as cases with standard scores up to four. The values with more than four standard scores were defined as outliers for the water consumption data in this analysis. This relatively high standard score was adopted because of the cases of the months that included the water consumption of more than one month as described earlier. If the standard scores were less than four, the months including the water consumption of more than one month were likely to be defined as outliers. However, there was no need of deleting such cases since the water consumption of the months without meter reading was zero, and the average would become the same. The outliers of the independent variables were detected by creating a stem-and-leaf plot. The extreme values were examined by considering the shape of the distribution of the values.

Fifth, with regard to the question on the available hours of water from the tap, most of the answers were distributed in the range of 1 to 12 hours and there were no customers who

answered in the range of 13 to 23 hours. Instead, there were few customers who answered 24 hours. This situation happened because some customers included the time when the household is sleeping and the others did not. In order to avoid the error of this gap, the data of the customers who answered 24 hours were converted to 12 hours.

In consideration of the above points, 64 samples were deleted due to the existence of outliers or more than 15 percent of the missing data in the water consumption data. One sample was deleted due to the existence of outlier in the number of household members. As a result, 134 samples remained for the final dataset. The level of precision of this sample size was the confidence interval of 7.7 with the confidence level of 95 percent. In addition, there were eight samples which were converted to 12 hours from 24 hours for the availability of water.

3.4. Validity and Reliability of Data

Validity is an extent to which a measure or set of measures correctly represents the concept of study, whereas reliability is an extent to which a variable or a set of variables is consistent in what it is intended to measure (Hair et al., 2010, pp. 2-3; Creswell, 2009, pp. 190; Denscombe, 2007, pp. 296).

Procedures taken in this research for ensuring validity and reliability in the employed research techniques are shown in **Table 3-5**.

Picture: Training on questionnaire survey

Table 3-5: Validity and reliability procedures for research techniques employed

Techniques	*Validity and reliability procedures*
Observation	**Validity**: • Use of observation schedule contains a list of items to be observed • Conducting observation with more than one investigators and cross-checking the observation result • Triangulation with data collected from the other research techniques **Reliability**: • Preparation of map contains a predetermined route for observation and walk with same pace
Semi-structured interview	**Validity**: • Directly interviewing the informants by the researcher • Use of interview guide • Recording and transcribing the data • Triangulation with data collected from the other research techniques **Reliability**: • Not applicable as same semi-structured interviews were not conducted
Use of secondary data	**Validity**: • Use of check list for secondary data collection • Verification of secondary data by triangulation with interviews • Handling outliers for the water consumption data **Reliability**: • Not applicable
Questionnaire	**Validity**: • Employing the questions related to the selected variables identified by the literature review • Avoiding the ambiguous wording in the questions • Good translation of questionnaire format • Training of the local surveyors • Pre-testing of the questionnaire • Piloting of the questionnaire • Checking the collected data to make sure that no errors arising from the data entry mistakes • Triangulation with observation **Reliability**: • Directly gathering questionnaire data by the same researcher and assistant • Training of the local surveyors

3.5. Ethical Considerations

Doing ethical research in a foreign setting is about building mutually beneficial relationships with people you meet in the field and about acting in a sensitive and respectful manner (Scheyvens and Storey, 2003, pp. 139). Ethical issues were considered and necessary measures had taken in the research, especially in the fieldwork.

Informed consent was obtained from ZAWA before the fieldwork, so that they clearly understood the aims and processes of the fieldwork. Also, informed consents were obtained

verbally from the informants of the questionnaire. The description of the questionnaire was written in the questionnaire format in Swahili including the statement for explaining the purpose of the study, who the researcher is, basic rights of the participants, privacy and confidentiality. The surveyors of the questionnaire survey read this statement and consents were obtained from the informants.

The data collected in the fieldwork was kept in a confidential manner. The researcher stored the recorded interviews and completed questionnaire formats in a secured place throughout the study.

Although the researcher cannot control the full appearance, the researcher tried to minimize the power gradient between researcher and informants of the questionnaire, by wearing the clean and tidy clothes that are commonly worn by the local people e.g. polo shirt and trousers. This measure was also important from the aspects of paying respects to the people in the Islamic society.

Necessary safety measures and health measures had been taken during the fieldwork in accordance to the official travel advice for the research area. Travel insurance was also obtained.

3.6. Chapter Conclusion

This chapter described the methodology for answering the research questions. The first and second research questions were mainly answered by the results of interviews and analysis of the collected secondary data. The third research question was mostly answered by the quantitative analysis based on the metered water consumption data and the data collected from the household questionnaire survey. Observation was employed to triangulate the data collected from the other sources, especially for the data on the service situation and water usage of the households in Makadara. Collected data are summarized with the corresponding research questions in **Table 3-6**. The codes written in the table are corresponding with **Table 3-2**, **Table 3-3** and **Table 3-4**.

Table 3-6: Summary of collected data

Research Questions	Secondary data	Semi-structured interview	Observational walk	Questionnaire
1. What was the water service situation of ZAWA before the introduction of volumetric tariff?				
Institutional set-up	S1, S2, S3, S4	I1, I3, I4		
Organizational status	S5, S6, S7	I4		
Human and financial resources	S8, S9	I1, I3, I4		
Water supply situation	S10, S11, S12	I1, I3	√	
Cost recovery	S8, S13	I1, I3		
Mission, visions and goals	S13, S14	I3		
2. What was the process of introducing the volumetric tariff?				
Drivers for introducing volumetric tariff	S4	I1, I3		
Legal adjustment	S3	I3		
Process of designing a tariff	S9	I3		
Meter installation plan e.g. schedule, meters, maps, etc.	S9, S15, S16	I1, I2, I5		
Human and financial resources	S9	I1, I3		
Public relation and information to the customers	S9	I1, I3, I6		
3. What are the effects of volumetric tariff on residential water consumption?				
Metered water consumption	S16, S17			
Water usage			√	Q1, Q2, Q3, Q4, Q9, Q13
Accessibility and cost of alternative sources			√	Q14-19
Service hours			√	Q5
Water pressure			√	Q6
Number of household members				Q27, Q28
Income level (including proxy questions)				Q20, Q21, Q22
Household composition				Q27, Q28, Q29
Awareness on the month of tariff change				Q12
Climate	S18			

Chapter 4. Results and Analysis

This chapter presents the results and analysis based on the methodology. Section 5.1, 5.2 and 5.3 are corresponding to the research questions. Result of the situation analysis of ZAWA before introducing the volumetric tariff is shown in section 5.1. Since ZAWA had recently developed their institutional structure and resumed their water pricing operation for the domestic customers, their establishment and process of resumption of residential water pricing were also summarized. Section 5.2 summarizes the process of transition from fixed rate to volumetric tariff in Makadara. Section 5.3 presents the descriptive information of Makadara and results of the analysis on effects of volumetric tariff on residential water consumption. Based on the analysis carried out in these sections, section 5.4 discusses the effects caused by introduction of volumetric tariff in the light of main objectives required in water tariff. The chapter was summarized in section 5.5.

4.1. Situation Analysis of ZAWA before the introduction of volumetric tariff

- ***Institutional Development of ZAWA***

When Zanzibar became independent in 1964, water was not free. The revenue was collected from both industrial and domestic users. It was only the public institutions who were exempted from payment (JICA, pp. 52). The water supply sector was under the control of the Department of Water Development (DWD) in the Ministry of Water, Construction, Energy and Lands (MWCEL).

In 1982, the Revolutionary Government of Zanzibar (RGZ) declared free water for domestic users. The reason of this declaration was to manage the increased complaints from the citizens due to the deteriorated water supply services caused by economic recession. There were several reasons for the recession such as the financial impact from oil crisis in 1970s, additional expenditure attributing to the war against Uganda between 1978 and 1979 and its aftermath, and the fall in the international price of cloves which was the main cash crop of Zanzibar. Ironically, the water supply services in Zanzibar became worth as RGZ could not generate the financial resources for basic operation and maintenance of their assets (JICA, pp. 52, preliminary study).

The discussion on water pricing was resumed by the pressures from the donors. During 1989 and 1990, RGZ developed a master plan namely Zanzibar Urban Water Supply Development Plan 1991 – 2015 with the grant provided by Finland, which was followed by the rehabilitation

of the existing infrastructures in the urban areas. In the master plan, several recommendations were made for RGZ such as development of the water policy, establishment of the system for water pricing and institutional capacity development for water supply services. During 1998 and 1999, the African Development Bank also pressurized the government to develop the water policy immediately (JICA, 2002, pp. 52-53).

In 1999, RGZ started to review the recommendations from Finland in response to the pressures from the international donors. In the Zanzibar Vision 2020, which was launched by RGZ as the national vision in 2000, it was clearly stated that the government is aiming to institute and maintain an efficient and effective water tariff, billing and timely revenue collection system for all water uses (RGZ, 2000, pp.24).

In 2002, MWCEL prepared the draft version of the National Water Policy, Water Act, Water Supply Rules and Procedures, water tariff for urban areas of Zanzibar and an act for establishment of water supply authority. These documents were reviewed in 2003, by the consultants hired by UNDP. The idea of establishing the water authority was after the model of water supply system in Dar es Salaam, which was managed by Dar es Salaam Water and Sewerage Authority (DAWASA) (JICA, 2002, pp. 54).

In 2004, National Water Policy was approved by the House of Representatives of the Zanzibar Government. In the policy, institutional reform in the water supply sector and reintroduction of water tariff to all users were officially adopted. In 2006, the Water Act for establishing ZAWA was enacted with the jurisdiction to manage the water in Zanzibar. The major function of ZAWA is shown in **Box 4-1**.

Box 4-1: Major function of ZAWA stipulated in the Water Act

- To control, manage and protect all catchment areas and is mandated to take legal actions against any person or body of persons in violation of, or disturbing or encroaching the catchment areas;
- To develop and maintain waterworks, plan and execute new projects for supply of water;
- To collect fees for water supplied and services offered to consumers;
- To advise the Government in formulation of policies relating to the development and conservation of water; and
- To propose to the Board amendments of water tariffs and water service charges as considered necessary.

Source: ZAWA (2006)

The Act also legitimated the constitution of the Board of ZAWA, which consists of five members including the chairperson who will be nominated by the President and the Director General of ZAWA. A good level of autonomy of ZAWA was defined in the Act, as the board

was given the power to approve the tariff amendments, staff recruitments and other important decisions (ZAWA, 2008a, pp.2).

Zanzibar Water Authority was established in August 2006. The staff of ZAWA were mainly transferred from DWD. There were approximately 800 staff in DWD, and 460 staff were working for Unguja Island. Since DWD was collecting water tariff from approximately 230 commercial customers only, engineering sections were dominating the organization. According to the customer directory kept by ZAWA, there were around 47,000 domestic customers in 2007. Instead of the large number of customers, only 21 staff in the Revenue Collection Unit were managing the customer services and revenue collection for the whole customers in Unguja Island. (JICA, 2007, pp. 3-10)

ZAWA had gradually transformed to the new organizational structure, which consists of four departments: Technical Department, Commercial and Customer Service Department, Finance and Administrative Department and Pemba Branch (**Figure 4-1**). Directors for Technical Department and Commercial and Customer Service Department were newly employed in 2007, because there were no staff who had adequate backgrounds (JICA, 2007, pp. 3-10). At the end of 2008, there were 330 staff in the Technical Department, 26 staff in the Commercial and Customer Service Department and 77 staff in the Finance and Administrative Department respectively (JICA, 2008, pp. 2-3). This composition of the staff implies the limited capacity for the customer services.

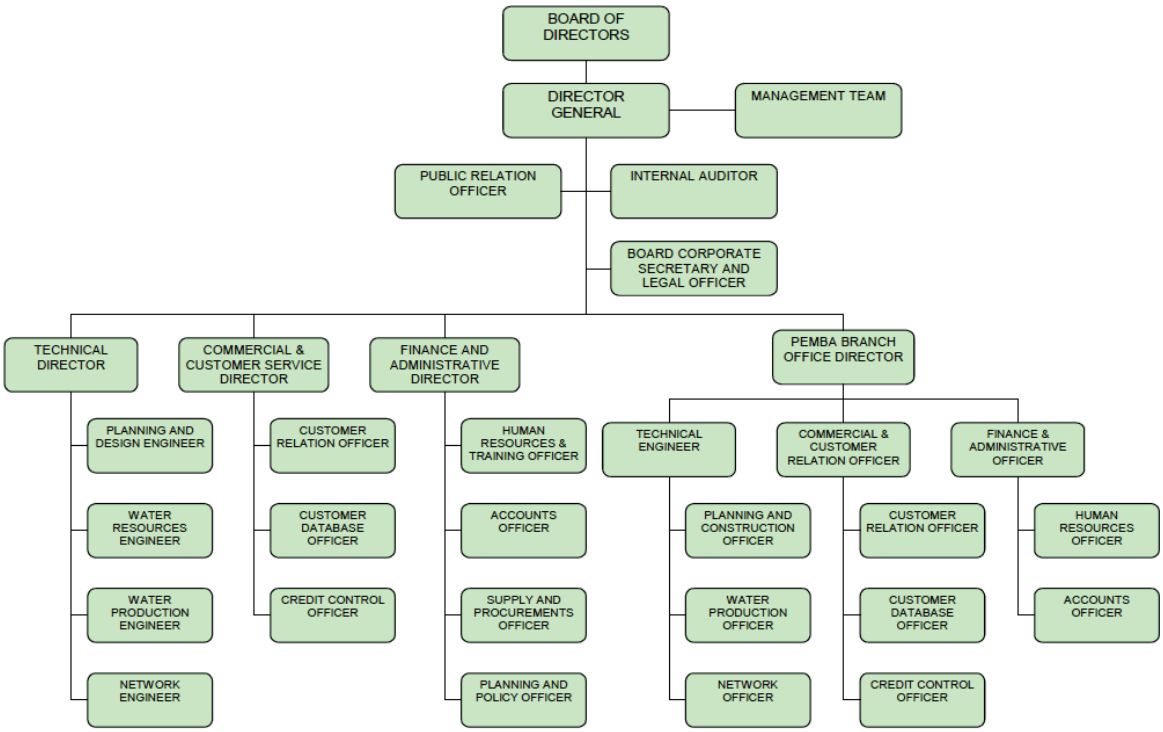


Figure 4-1: Organogram of ZAWA

(Source: ZAWA, 2008a, pp. 57)

- ***Human Resources Management***

Development of human resources was a great challenge for ZAWA since no one had experience on working as an autonomous water utility. There were no guidelines or manuals for human resources management, financial management and customer relations (JICA, 2005b, pp. 3-76). The human resources assessment conducted for 310 staff in February 2008 revealed that the staff were lacking from sense of working efficiently and effectively, and they were confused by their organizational change to an autonomous authority. Hence, many staff were requesting for opportunities of trainings (JICA, 2010a, pp. 10).

To develop the competence of ZAWA, there were four main tasks to be tackled: 1) enhancement of the role of the managers to motivate their subordinates; 2) preparation of job descriptions for every staff; 3) establishment of a transparent and fair personnel performance evaluation system; and 4) development of human resources development plan (JICA, 2010a, Annex 1.6 pp. 7).

As one of the measures for enhancing the capacity of the managers, the five-year Strategic Business Plan was prepared by ZAWA in association with National Water and Sewerage Corporation of Uganda in June 2008. ZAWA formulated a vision, mission, motto and values in the Strategic Business Plan as shown in **Box 4-2**. In the next month, the Code of Ethics and Conduct for ZAWA staff was prepared based on the Strategic Business Plan and promoted to all the staff (ZAWA, 2008b, pp. i, vi). Their vision, mission, motto and values have been kept the same in the revised version of the Strategic Business Plan in 2013 (NIRAS, 2013, pp. 27).

Box 4-2: Vision, mission, motto and values of ZAWA

- ***Vision*** – to be the best water and sanitation service provider in East Africa
- ***Mission*** – to develop and provide potable, adequate, affordable water supply and sanitation services in a sustainable and environmentally friendly manner
- ***Motto*** – every drop counts; use water wisely
- ***Core values*** – teamwork and transparency; customer satisfaction; competent, committed and motivated staff; good governance; environmental sustainability; efficiency and effectiveness; gender sensitivity; corporate social responsibility and networking.

Source: ZAWA, 2008

The board officially approved the job descriptions for each staff in March 2009 (JICA, 2010, pp. 40). The responsibility, core function and required qualifications and experiences were clearly described in the job descriptions. However, there were gaps between the job descriptions and the ability of staff. Assessment of the staff ability and new recruitment of competent staff had been continuously carried until March 2014 (Result of interview: Code I4).

Establishment of transparent and fair personnel system and human resources development plan were the difficult areas to achieve. According to the staff of Human Resources Section, it is common in Tanzania that promotions or salaries of staff are defined by the staff's certificates and educational degree no matter how competent the staff is (Result of interview: Code I4).

Many trainings were conducted for ZAWA staff yet trainings were not regularized. From January 2008 to December 2010, ZAWA had worked together with six international experts dispatched by JICA. Mostly, ZAWA's staff were trained by the experts from their daily operations but there were also some area-focused trainings conducted.

- ***Systems and Procedures Development***

It was necessary for ZAWA to establish comprehensive customer database, asset management system, accrual accounting system, payroll system and billing system before billing the domestic customers.

Information of the customers in Urban District and West District were collected from the consumer survey carried out with the support of Shehia and the Office of Chief Government Statistician. For the customers in other district, existing information on registered customers was used. Collected data was entered into the newly installed customer database software which was also used in the water utilities of Tanga, Arusha and Mosi in the mainland. In total, 63,187 customers were registered in the database. The number of the customers was much larger than expected (JICA and ZAWA, 2009, pp. 10).

Physical assets of ZAWA were entered into a GIS database. Geographical information which was recently prepared by MCWEL was used and the locations of the water supply facilities were verified with GPS by the staff of Technical Department. Entry of the data of Urban District and West District (e.g. water sources, pumps, reservoirs, transmission and distribution network and public standpipes) was completed in December 2009. Geographical information of the customers in the Urban and West Districts were also verified with GPS and consolidated with the customer database (JICA, 2010, pp. 12).

Software suppliers conducted trainings every year for handling the installed system. Trainings for customer database and preparation of the billing documents were conducted for 15 staff in the Credit Control Section, IT Section and the cashiers. Trainings for GIS were conducted for 15 staff in the Technical Department. Trainings for accounting and payroll system were conducted for 13 staff in the Finance and Administrative Department (JICA, 2010, pp. 12).

- ***Water Supply Situation***

The population censuses were conducted in 2002 and 2012. According to the census of 2012, the population in Unguja Island was 896,721 people (178,018 households) and out of that, 223,033 people (42,196 households) were living in the Urban District. There was no accurate data for service coverage. Service coverage for entire Zanzibar was 65 percent in the Strategic Business Plan prepared in 2008. For the urban area, service coverage was 98% in the census conducted in 2002, whereas that of the Urban District was estimated as 61 percent in the household survey conducted by ZAWA in 2012 (ZAWA, 2014, pp. 2-1 and 2-3). Discrepancies among the figures were due to lack of accurate customer data as the information of the most of customers were not updated since their registration.

Water for the Urban District was supplied mainly from springs until 2010. The water from two springs were transmitted to three ground reservoirs (cumulative capacity of 3,250 cubic metres) and then pumped up to two elevated reservoirs in Saatini Station, which had cumulative capacity of 900 cubic metres. There was a large seasonal fluctuation in the production capacity of two springs, depending on the rainfalls. Comparing the dry and wet seasons, the production was halved in the dry seasons (JICA, 2007, pp. 3-27). Usually the elevated reservoirs were filled in only once a day and the situation became worse in the dry season (Result of interview: Code I3).

Since 2010, the yield of two springs decreased drastically due to the drought (Interview I3). However, ZAWA was able to transfer the water to Saatini Station from the other water supply scheme. Fortunately, distribution main from the other water supply scheme to the Saatini Station was constructed in 2008 to feed the elevated tanks by gravity flow, in order manage the situation when there is no electricity for pumping up the water from the ground reservoirs (JICA, 2005b, pp. 3-30).

The distribution network from the Saatini Station to the Urban District was constructed between 1950s and 1970s. Asbestos cement pipes were used for more than 50 percent of the large diameter pipes. Most of the areas were receiving water intermittently. Water pressure was generally low as the water head during the daytime was only two to three meters even in the areas with relatively high water pressure (JICA, 2008, pp. 2-15). Households used to store water in their private storages when the water is available. Some people did not even close their taps throughout the night in order to store the water (Result of interview: Code I3).

Non-revenue water (NRW) was estimated as 90 percent in 2008. This figure was based on the rough estimation because water production as well as consumption was not metered at that time. Water losses and unbilled authorized water consumption were estimated to be around 63 percent and 27 percent, respectively (ZAWA, 2008, pp. v).

- ***Beginning of Water Pricing to the Domestic Customers***

The first step for ZAWA to start the residential water pricing was to design a new tariff. Since there was no meter installed, ZAWA had to charge the customers with the fixed rate. However, they also had a plan to bill the customers with the volumetric tariff in the future. Therefore, ZAWA decided to design a water tariff including both fixed and metered rate. The major principles for tariff design adopted by ZAWA are shown in **Box 4-3**. Although there was a principle for revenue sufficiency, the target was vague as there was no agreed financial forecast when the principles were agreed. Financial forecast was prepared later in June 2008.

Box 4-3: Major principles for tariff design for ZAWA's residential customers

- Tariff structure should include both volumetric and fixed rates
- Fixed rate should be universal for all the households regardless of the household characteristics
- Fixed rate should not exceed four percent of the average household income
- Volumetric tariff should be moderate increasing block tariff
- Volumetric tariff should be reasonable than the fixed rate, so that customers would be motivated to shift to volumetric tariff
- Commercial customers should be separated with domestic customers and cross-subsidies from the commercial to the domestic should be applied
- Tariff structure should allow ZAWA to recover the operation and maintenance cost in the foreseeable future
- Frequent changes of the tariff structure should be avoided

Source: JICA, 2010, pp. 13-14

Following the above principles, management of ZAWA designed a new tariff after studying the experiences of other water utilities, especially from the ones in the mainland of Tanzania. In March 2008, the tariff was submitted to the board and approved in the next month. The final tariff structure for residential customers is shown in **Table 4-1**. IBT was designed for the volumetric tariff. IBT contained the service charge of Tsh 600 and two blocks, which the prices were Tsh 250 per cubic metre up to eight cubic metres and Tsh 300 for more. It was designed to charge slightly less than the fixed rate if the customers consume 12 cubic metres per month.

Table 4-1: Water tariff for domestic customers

Categories of residential customers	***Type of Charges***	***Size of diameter of service pipe***	***Water consumption***	***Rate (Tsh/month)***
Metered customers	Service charges	1/2" – 3/4"	Not applicable	600
		1" – 1 1/2"		1,200
		2" – 3"		2,500
		4" and above		4,000
	Water charges	Not applicable	0 – 8 m3	250 per m3
			More than 8 m3	300 per m3
Unmetered customers	Water charges	Not applicable	Not applicable	4,000

Source: RGZ, 2008, pp. 133

Legal adjustment was made by amending the Water Act, which appeared on the government gazette by the Attorney General Office on 22 August 2008. The amendment of the Water Act was named as the Water Regulations of 2008. In the regulation, it was stipulated that "*all metered customers of ZAWA shall pay water fees depending on their actual monthly water consumption based on the water meter readings and volumetric tariff as prescribed in the Schedule 9 (volumetric tariff structure) to these Regulations* and *all non-metered customers or consumers of ZAWA shall pay their monthly flat rates water fees as prescribed in the Schedule 11 to these Regulations*" (RGZ, 2008, pp. 132-133).

The first billing for residential customers commenced from September 2008. ZAWA somehow managed to print and deliver the bills to more than 60,000 residential customers registered in the customer database, however there were many challenges involved. First, the information of the customers was inaccurate. Some of the customers in the database were not served by ZAWA and some of them were served but not registered as customer (JICA and ZAWA, 2009, pp. 11). Second, capacity of the bill attendants were not enough in terms of number of staff and their abilities. Despite the large number of the delivered bills, there were only 33 bill attendants in ZAWA. Manual for billing and collection was just prepared at the end of August 2008, thus the time for training of the bill attendants was limited (JICA, 2010, pp. 16). Third, people were not willing to pay for water. Many customers complained about the poor service of ZAWA. Some of them requested ZAWA to provide enough water without rationing the service hours. Some of the customers were requesting ZAWA to provide enough water for entire population of Zanzibar (Result of interview: Code I3).

Bill collection efficiency for residential customers in the first month was surprisingly low, which resulted as 0.9 percent. The performance was even stagnant for the following months, which was around 1.4 to 2.0 percent for the next five months (JICA and ZAWA, 2009, pp. 16).

Trainings for the bill attendants were continuously carried out after the commencement of billing exercise. In November 2008, practitioner from the Arusha Urban Water and Sewerage

Authority (AUWSA) was invited to ZAWA and educated the billing attendants on practical billing and collection procedures and complaint management. In May 2009, customer relation officer of the Zanzibar Electricity Company (ZECO) provided trainings for improving ZAWA's customer management skills (JICA, 2010, pp. 16-17).

ZAWA also worked vigorously on their public relations activities to make their customers understand about ZAWA's role and responsibility of paying for water. The three main measures of public relations activities were public meetings, promotion through television programme and disconnection campaign with the mobile cashier vehicle.

Public meetings were facilitated by the local leaders in each Shehia. In the meeting, ZAWA explained to the community: why people have to pay for water; what is the situation of water in Zanzbar; and how the drinking water is produced and served to the customers. Then, the community members were invited for the questions. The keyword for changing the customers' behaviour was "contribution". ZAWA was not enforcing the customers to pay for water but asking them to contribute to the water services. **Box 4-4** shows the examples of the discussion in the public meetings. Until October 2009, public meetings had covered 58 percent of the Shehias in the Urban and West Districts (JICA and ZAWA, 2009, pp. 13).

Box 4-4: Examples of discussions in the public meetings on water pricing

Now the people have the questions.
"Why? Water was free before. Now, why is the government asking us to pay for water?"
"The reason behind this is, subsidy for water is a huge burden for the government. The government needs to invest for education sector, health sector and other treatments. So the government wants the customers to pay for water, not the payment, the government wants contributions in order to make the water utility to operate well."
So it is not the payment, it is a contribution for the public services.

"Yes, we should pay for water because electricity is one of the components for producing water. If you want water, you should pay for electricity to get water."
The people have willingness to pay for electricity but they do not want to pay for water. Electricity is one of the inputs to the water, so if you tell like this, people understand to pay for water.
"If your house is paying for electricity, why not ZAWA? ZAWA is paying for electricity."
So the customers' contribution is for electricity and some minor maintenance.

Source: Results of the interview: Code I1

Second method for public relation was through the television programme collaborated with Television Zanzibar (TVZ). **Table 4-2** shows the contents broadcasted from May 2009 to January 2010. Those programmes were repeatedly broadcasted as there were not many programmes available in Zanzibar. There was a significant positive impact on people's awareness raising as watching television was one of the most popular entertainments in Zanzibar.

Table 4-2: Contents broadcasted by television for public relation

Type of programme	***Episodes***
Drama	1. ZAWA as independent public entity
	2. Why people need to pay water tariff
	3. How people can pay the water tariff
	4. ZAWA management: driven by customers' needs
Live show	1. Collecting water tariff
	2. Current ZAWA's initiatives
	3. Importance of water payment part 1
	4. Importance of water payment part 2
Documentary	Delivering safe water: ZAWA's new challenges

Source: JICA, 2010, pp. 19

Third method was the disconnection campaign targeting the delinquent customers. Before the due date of the payment, enforcement of disconnection was announced with the vehicle which was equipped with the mobile type cashier. The staff of ZAWA also accompanied the vehicle and explained to the delinquent customers that they could get rid of the disconnection operation if they pay the balance at the mobile cashier (JICA, 2010, pp. 25-26).

After these efforts, bill collection efficiency was improved. In Makadara Shehia, bill collection efficiency was 130 percent in June 2009 just after the disconnection campaign. However, the ratio dropped suddenly to almost 50 percent from the next month (JICA, 2010, pp. 46-47). Bill collection and changing the mindset of customers are still the big challenges for ZAWA.

- ***Financial Situation***

ZAWA prepared the 10-year forecast of income statements from the financial year of 2007/08 together with the Strategic Business Plan in June 2008. The forecast indicated that ZAWA could recover the full operation and maintenance cost excluding the depreciation by achieving the bill collection efficiency of 60 percent.

Table 4-3 shows the trend of ZAWA's income statements. The expenses less depreciation and amortization are seemingly well covered by the revenue. For instance, EBITDA (earnings before interest, taxes, depreciation and amortization) for financial year 2009/10 had the surplus of Tsh 2,706 million. However, according to the ZAWA's accounting policy, billed

revenues (not the collected revenues) were reported for each year and then uncollected bills were written off as bad debt when the bills were not collected for more than two years. In addition, most of the revenues were built up with the subsidies or grant (e.g. 66.7 percent of the revenue in 2009/10 was subsidies or grant).

Table 4-3: ZAWA's income statement (FY2008/09 - FY2012/13)

	FY2008/09	FY2009/10	FY2010/11	FY2011/12	FY2012/13
Revenue					
Billed revenue	4,677,358,750	2,613,279,644	3,567,438,360	3,651,536,590	4,282,841,147
Domestic	3,457,617,131	1,403,553,017	2,377,702,400	2,552,645,640	3,169,146,997
Commercial/Industry	960,435,824	1,052,652,984	927,574,048	814,272,250	766,200,550
Institutional	164,149,194	157,073,643	262,161,912	263,616,450	287,487,800
Kiosks	0	0	0	21,002,250	41,438,050
Agricultural	5,670,500	0	0	0	11,414,150
Service charges	0	0	0	0	7,153,600
Other income	5,011,355,035	5,561,218,501	6,175,015,812	7,142,308,219	6,999,805,348
Subsidies	1,248,510,828	2,543,975,072	2,070,096,335	2,746,517,849	2,004,000,000
Other income domestic	0	112,187,780	221,322,356	302,719,910	239,669,500
Subsidies-Grants	214,177,145	0	158,455,850	85,119,301	0
Grants amortization	236,020,519	320,088,509	509,867,437	673,473,771	858,830,224
Electricity subsidies	3,312,646,543	2,584,967,140	3,215,273,934	3,334,477,388	3,897,305,624
TOTAL REVENUE	9,688,713,785	8,174,498,145	9,742,454,172	10,793,844,809	11,282,646,495
Expenses					
Electricity cost	3,312,646,543	2,584,967,140	3,215,273,934	3,334,477,388	3,897,305,624
Payroll & related expenses	1,282,027,738	1,406,270,813	1,508,925,502	2,190,480,615	2,196,757,233
General & administration expenses	1,102,114,533	1,476,892,209	1,652,690,879	1,926,071,477	2,435,338,246
Bad debt			111,638,408	3,894,443,586	1,916,027,403
Provision for doubtfully debt			2,452,182,440	-868,162,489	295,611,812
TOTAL EXPENSES	5,696,788,814	5,468,130,162	8,940,711,163	10,477,310,577	10,741,040,318
EBITDA*	3,991,924,971	2,706,367,983	801,743,009	316,534,232	541,606,178
Depreciation	5,057,337,920	5,120,050,513	5,252,357,045	5,157,924,340	2,024,092,142
Amortization (non-tangible assets)	14,972,800	15,201,280	16,543,860	18,073,044	6,870,501
TOTAL EXPENSES INCLUDING DEPRECIATION AND AMORTIZATION	10,769,099,534	10,603,381,955	14,209,612,068	15,653,307,961	12,772,002,960
Profit (Loss) for the year					
	-1,080,385,749	-2,428,883,810	-4,467,157,896	-4,859,463,152	-1,489,356,465

* EBITDA: earning before interest, taxes, depreciation and amorization
* There were discrepancies in the "Billed revenue" of FY2008/09 and "Other income" of FY2010/11 but they are shown in the table as it was
Source: Board of directors' report and financial statements

Collection efficiency for the financial years from 2007/08 to 2012/13 is shown in **Table 4-4**. Firstly, the billed amount in the financial year of 2008/09 increased for almost nine times more than the previous financial year. Secondly, the performance of collection efficiency was very poor. In the financial year of 2008/09, the collection efficiency for domestic customers was only 6.2 percent, which was far behind from 60 percent. Although the collection efficiency for the domestic customers became 23.3 percent in the next financial year, still the performance was poor. Thirdly, the billed amount in the financial year of 2009/10 decreased suddenly. The reason for this situation was due to extensive power outage of entire Zanzibar caused by the damaged undersea cable that connects the grid between the mainland and Zanzibar. The power blackout continued for almost four months and it was impossible for ZAWA to serve water and issue bills.

Table 4-4: Collection efficiency (FY2007/08 - FY2012/13)

Unit: Tsh

	FY2007/08	FY2008/09	FY2009/10	FY2010/11	FY2011/12	FY2012/13
Billed amount	**529,618,718**	**4,677,358,750**	**2,613,279,644**	**3,567,438,360**	**3,651,536,590**	**4,282,841,147**
Domestic customers		3,457,617,131	1,403,553,017	2,377,702,400	2,552,645,640	3,169,146,997
Commercial/Industry customers		960,435,824	1,052,652,984	927,574,048	814,272,250	766,200,550
Institutional customers		164,149,194	157,073,643	262,161,912	263,616,450	287,487,800
Kiosk		0	0	0	21,002,250	41,438,050
Agricultural customers		5,670,500	0	0	0	11,414,150
Service charges		0	0	0	0	7,153,600
Collected amount	**417,980,315**	**533,434,822**	**673,517,541**	**985,079,312**	**1,442,889,848**	**1,303,488,475**
Domestic customers		215,516,060	326,661,415	289,555,383	641,544,419	591,632,651
Commercial/Industry customers		274,953,847	321,098,633	622,160,127	667,580,238	588,621,333
Institutional customers		42,964,915	25,757,493	73,363,802	133,765,191	118,018,984
Kiosk		0	0	0	0	694,800
Agricultural customers		0	0	0	0	0
Service charges		0	0	0	0	4,520,707
Performance: collected in % of billied	**78.9%**	**11.4%**	**25.8%**	**27.6%**	**39.5%**	**30.4%**
Domestic customers		6.2%	23.3%	12.2%	25.1%	18.7%
Commercial/Industry customers		28.6%	30.5%	67.1%	82.0%	76.8%
Institutional customers		26.2%	16.4%	28.0%	50.7%	41.1%
Kiosk		N/A	N/A	N/A	0.0%	1.7%
Agricultural customers		0.0%	N/A	N/A	N/A	0.0%
Service charges		N/A	N/A	N/A	N/A	63.2%

* Figures for billed amount are based on the income statements

* Figures for collected amount are based on the Note 15 of the Board of directors' report and financial statements 2012/13, however the figures for service charges in FY2008/09, FY2009/10, FY2010/11, FY2011/12 were not included as they were not included in the income satements

Source: Board of directors' report and financial statements

Figure 4-2 shows the operating revenues and expenses of ZAWA from financial year 2008/09 to 2012/13. Collected revenue and the other income from domestic customers were included in the operating revenues. Electricity cost, payroll & related expenses and general & administration expenses were included in the operating costs. The ratios of total operational revenues over total operating costs were far behind from the ideal situation.

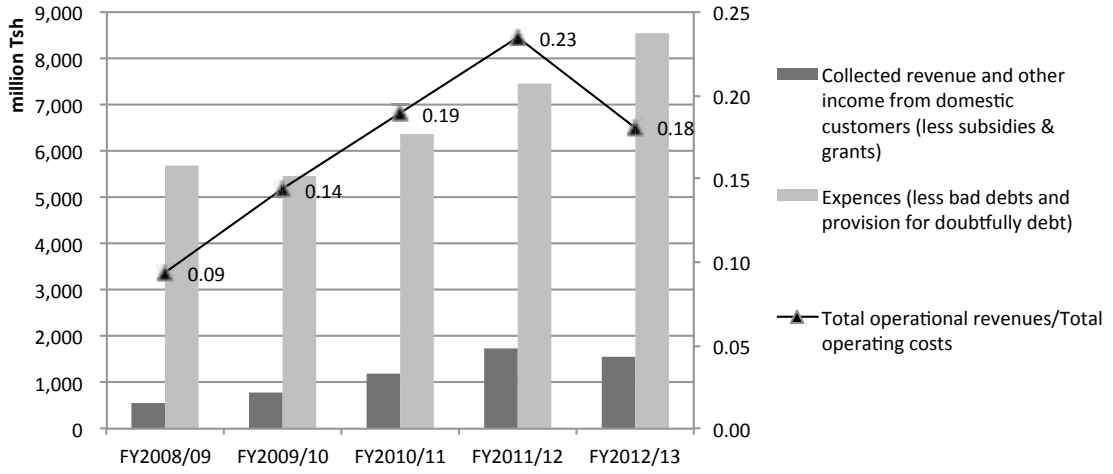


Figure 4-2: Operating revenues and operating costs of ZAWA (FY2008/09 - FY2012/13)

(Source: adopted from ZAWA)

4.2. Process of Introducing Volumetric Tariff

The idea of introducing the volumetric tariff already existed in 2003 before the establishment of ZAWA because ZAWA was modeled after DAWASA which was charging domestic customers with volumetric tariff. The volumetric tariff was included in the draft version of the bill of an act for establishment of water supply authority. However, when the bill was authorized as the Water Act in 2006, the tariff was excluded from the Act, based on the idea that the tariff should be carefully designed by ZAWA after their establishment.

The volumetric tariff was enforced as the part of Water Regulation in 2008, even though there was no meter installed for domestic customers at that time. ZAWA decided to introduce the volumetric tariff from the pilot basis, because ZAWA realized their limited capacity to control their water pricing operation in the entire country after the commencement of the water pricing to the residential customers in 2008 (JICA, 2010, attachment 5.1).

ZAWA selected the Makadara Shehia as a pilot area for introducing the volumetric tariff. The area was selected for their relatively good condition of water services as Makadara was located just next to the Saatini Station and water pressure was better than the other areas. In addition, location of Makadara was close to the headquarters of ZAWA and it enabled them to monitor the area easily.

The original plan for introduction of volumetric tariff in Makadara is shown in **Table 4-5**. Two task forces were formulated for the implementation of the plan. One was for investigating the location of service connection pipes and installation of meters. Another was for meter reading, bill delivery and collection. The plan was slightly delayed and public relation activities for explaining the installation of meters and volumetric tariff to the customers were conducted from May 2009.

Table 4-5: Planned activities for introduction of volumetric tariff in Makadara

	2009								
	4	5	6	7	8	9	10	11	12
1 Public relation activities									
2 Formulation of task forces									
3 Trainings for revenue collection based on volumetric tariff									
4 Customer inventory survey and data entry									
5 Obtaining consent for meter installation									
6 Installation of 300 customer meters									
7 Practicing meter readings, bill deliveries and collection									

Source: JICA, 2009, Annex 5

Before the trainings, ZAWA reviewed the performance of their metering operation for the commercial customers. ZAWA was already practicing the metering for approximately 50 commercial customers at that time. The review identified mainly two problems. First, ZAWA did not have standard specifications for meter installation. Some of the meters were installed in the place where it can be easily tampered and some were installed in the place where it was difficult for ZAWA staff to access. Secondly, ZAWA did not have format for recording the meter readings. Therefore, it was difficult for ZAWA to avoid the reading errors and to identify the malfunctioning meters. From these findings, ZAWA decided to prepare the formats and guidelines for meter installation and reading, so that the meters could be installed properly at the secured place with good accessibility and the readings could be recorded accurately. In addition, meter inspection yard was constructed for checking the accuracy of meters and carrying out the trainings for meter installation and reading (JICA, 2010, pp. 28).

Picture: Meter inspection yard

Members of the task forces first received trainings in AUWSA. The staff learned about the meter reading activities such as patrolling planning, preparatory work before meter reading and data transfer to the database. Then the further trainings were conducted in Makadara.

Customer inventory survey was conducted for collecting the accurate customer data. Every household in Makadara was visited and customer data was updated. Detailed customer map was also prepared. In the customer inventory survey, customers were explained about their responsibility for paying for water, ZAWA's Customer Charter, installation of meters and change to the volumetric tariff. They were also informed that the volumetric tariff has an advantage that they will be charged less if they could save the water. Once the customer agreed on installation of meter, the agreement was signed between the customer and ZAWA.

ZAWA was almost ready to introduce the volumetric tariff. There were already 290 customers who agreed to install the meters. However, in July 2009, the plan was interrupted by political influence. Minister of MWCEL announced to halve the fixed rate from Tsh 4,000 to 2,000, even without any amendment of the Water Regulation. The customers in Makadara started to complain about installation of meters since the volumetric tariff was designed to charge slightly less than Tsh 4,000 if the customers consume water averagely. Unfortunately, there was no other option for ZAWA to postpone the introduction of volumetric tariff (JICA, 2010, pp. 14 and Interview: Code I3).

After the consultation with the stakeholders, ZAWA decided to install the meters universally for the customers in Makadara. Therefore, ZAWA started to procure additional 500 meters. However, another nightmare was awaited. While procuring the water meters, Zanzibar faced a long blackout from December 2009 to March 2010. The supplier of the water meters was not able to fulfill their contract of supplying the meters in the agreed period and accordingly the contract was terminated (JICA and ZAWA, 2010b, pp. 13-14). The arrival of the meters delayed for almost one year from the original plan.

The impact of the blackout was not only affecting the procurement schedule but also affected the willingness to pay of the customers. The customers became reluctant to pay for water because the water became free for the period of the blackout. **Figure 4-3** shows the trend of collection efficiency in Makadara from June 2009 to October 2010. The ratio was high in June 2009 because of the success in disconnection campaign and then it dropped to 40 to 60 percent. From November 2009, the collection of delivered bills became difficult because it was difficult for ZAWA to supply water without electricity. In consequence, ZAWA could not recover the collection efficiency at the same level before the blackout after March 2010.

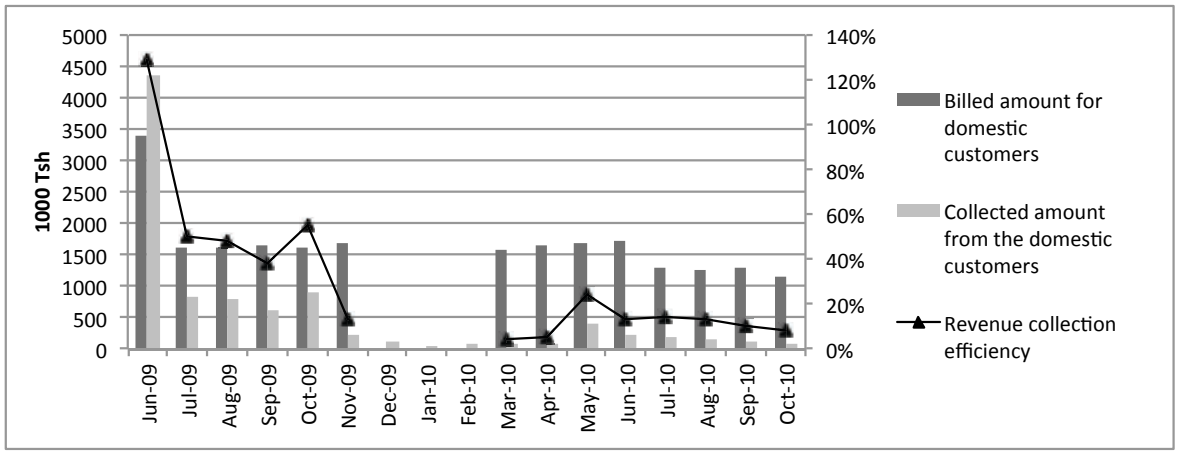


Figure 4-3: Collection efficiency from domestic customers in Makadara (June 2009 - October 2010)

(Source: JICA, 2010, pp. 46-47)

ZAWA resumed their plan for introducing volumetric tariff from June 2010. ZAWA broadcasted the documentary on transition from the fixed rate to volumetric tariff and advantages of the volumetric tariff through television. ZAWA also conducted the public meetings for the people in Makadara (JICA, 2010, pp. 37). Initially, many people refused to install the meters, but eventually they agreed to install them. Some of the discussions in the public meetings are shown in **Box 4-5**. ZAWA made their utmost effort to make the people feel confident on installing the meters. ZAWA also gave some incentives for installing the meters. From the month of meter installation to the month of starting of the volumetric tariff, only the service charge was billed to the customers (Result of interview: Code I3).

Box 4-5: Examples of discussions in the public meetings on volumetric tariff

"Why Makadara?"
"This is an opportunity for you. The people of ZAWA chose you. When you install meters, you will create close relationship with ZAWA. Every time you can ask to our staff what is going on, and we will visit your place and resolve the issues immediately."
"Are you going to have a plan for the other areas as well?"
"Yes, after graduating from this study in here, we will disseminate to the other areas. Please be a good teacher for the others. People in the other areas may come to your place to learn" (Result of interview: Code I2)

"If you install the meters and you are not getting the water for someday, the meter will not detect anything. But if you are using the fixed rate, we would not know how many days you are not getting water. So you have to contribute regardless of your water consumption. If you install the meter, it means that the meter can only reflect the amount you consumed."
"That is fantastic! Please come to fix the meter in my house." (Result of interview: Code I3)

"Why are you installing the meters to us? Our bill will be higher."
"This is a pilot area. If this pilot area had no issues, we will install the meters to the other areas of Zanzibar. For the time being, we are installing the meters to your house free. But the new customers need to pay for installing the meters. If you do not agree, we may select other areas as pilot areas."
"Okay, we want to install the meters, so that we can install the meters free." (Result of interview: Code I1)

A local contractor conducted trainings on meter installation. ZAWA staff installed 100 meters in Makadara during the eight-day training period in July 2010. **Figure 4-4** shows the number of meters installed in Makadara. Eventually, ZAWA installed more than 700 meters. Bill attendants and plumbers received refresh trainings before the commencement of volumetric

tariff. Two staff from AUWSA conducted trainings for meter reading and meter maintenance by using the training yard. ZAWA staff also learned about how to use the data loggers.

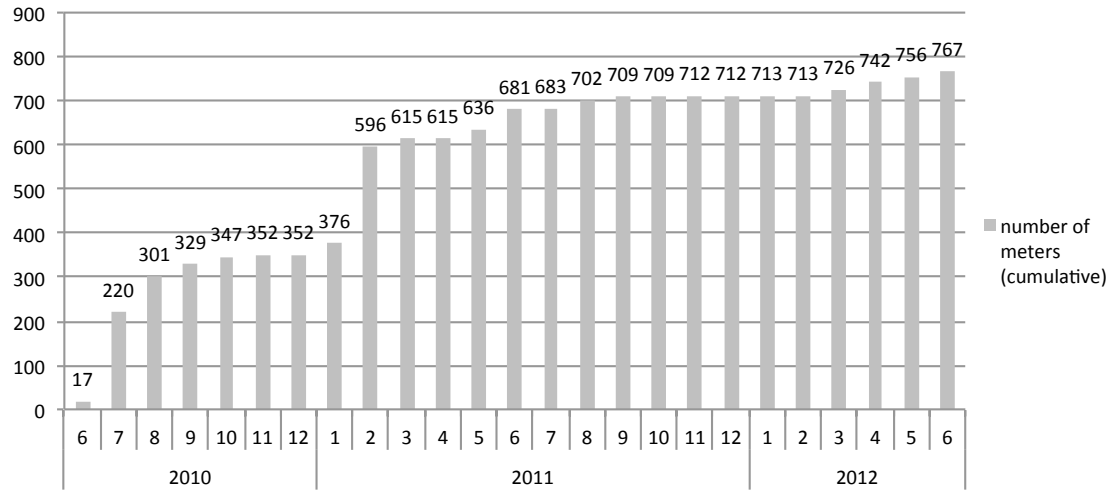


Figure 4-4: Cumulative number of installed meters in Makadara (June 2010 - June 2012)

(Source: Adopted from ZAWA)

Public meeting with Sheha (local leader of Shehia) and the community was organized in November 2010 and ZAWA obtained the consensus for shifting to the volumetric tariff entirely in Makadara. The first set of bills based on volumetric tariff was delivered in the beginning of December 2010 to approximately 350 metered customers. The consumption was calculated from the first meter readings on 22 October 2010 and the second readings on 18 November 2010 (JICA, 2010, pp. 37-38).

4.3. Effects of Volumetric Tariff on Residential Water Consumption

- ***Descriptive Analysis of the Questionnaire Samples***

Makadara is a residential area in the Urban District of Zanzibar. **Figure 4-5** shows the water distribution zones in Makadara. Small squares plotted in the map are showing the residences. According to the census conducted in 2012, the population of Makadara was 5,048, which was about two percent of the population in Urban District. The area size of Makadara was 349,993 metre squared (The United Republic of Tanzania, 2013, pp.234, 236).

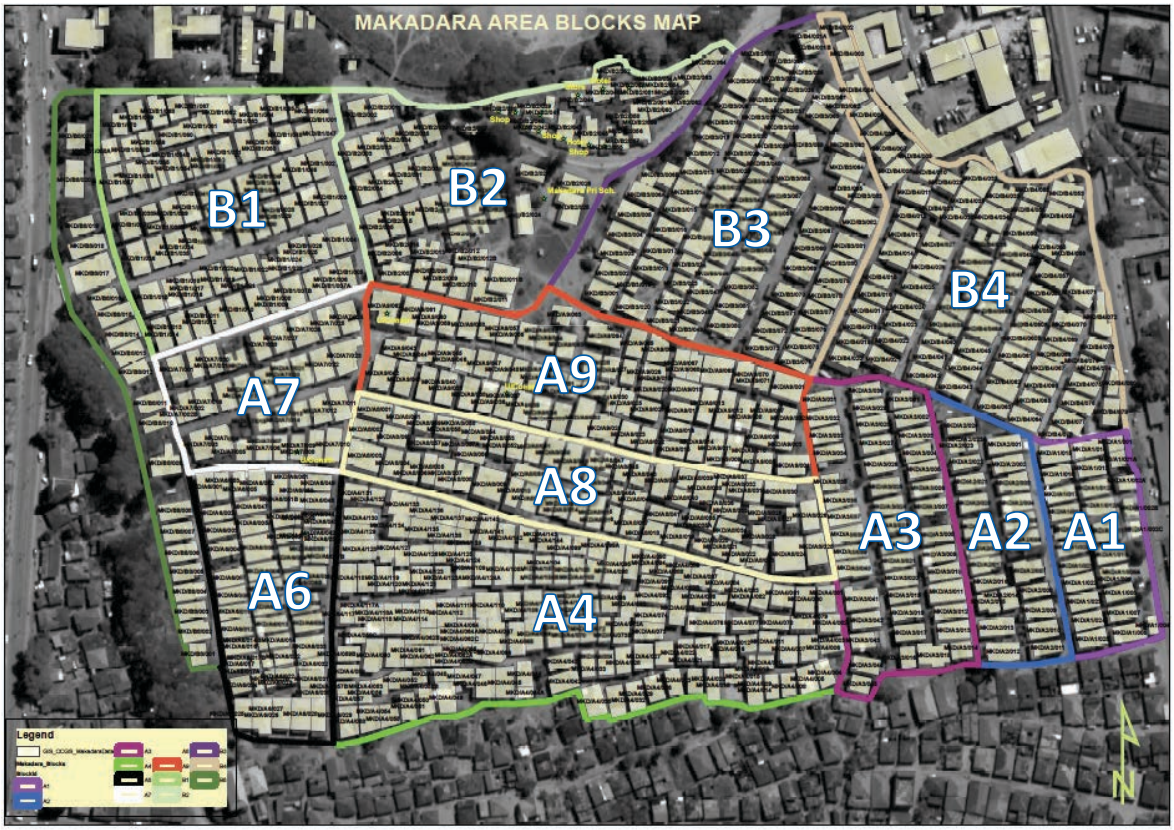


Figure 4-5: Distribution zones in Makadara

(Source: ZAWA)

According to the questionnaire, the average household size was 5.8 people and the average numbers of male and female were 2.7 and 3.1, respectively. These figures were almost the same with the census data as the average household size was 5.3 and the gender proportion was exactly the same in the census. The average number of the children under the age of 18 in the household was 2.2 people.

There was a difficulty in collecting the answer for household incomes due to the sensitivity of the question. Only 66 households answered their household income whereas all the participants answered the question on the monthly electricity bill and payment for mobile phone, which were asked as proxy for understanding the level of affluence. **Figure 4-6** and **Figure 4-7** shows the histograms of the monthly income and electricity bill. In order to check the validity of the data, the results were compared with the data from the Zanzibar Household Budgetary Survey 2009/10 (The United Republic of Tanzania, 2012, pp. 106).

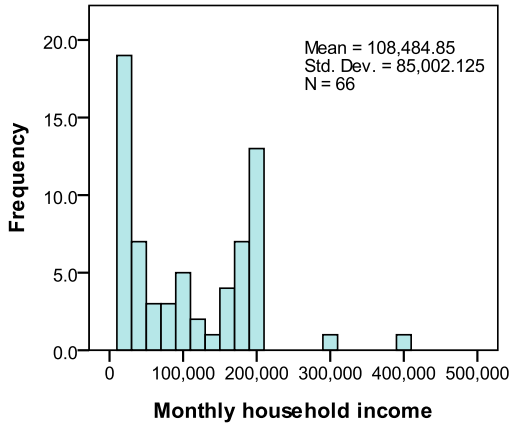


Figure 4-6: Histogram of monthly household income

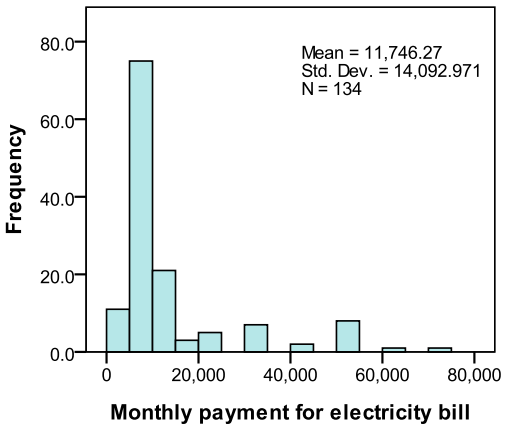


Figure 4-7: Histogram of monthly electricity bill payment

Regarding the distribution of monthly household income, there were mainly two groups in the population: households in the ranges of below and above Tsh130,000. In the Household Budgetary Survey, there was also a similar dispersion in the monthly household expenditures. However, the amount of the monthly expenditure largely differed from the data collected in the questionnaires as the mean was Tsh108,485 in the questionnaires and it was Tsh 344,740 in the Household Budgetary Survey. The reason of this gap is considered to be coming from the different methodology employed in the survey. In the Household Budgetary Survey, the household members kept a record of all the expenditures for a month. The gap in the figures implies that the households usually do not keep records of the expenditures and therefore understated their actual monthly income.

The positive distribution was observed for the electricity payment. The shape of the distribution was different from that of the household income but it was similar in the sense that some households were spending more than the average. For the households who were not paying for electricity, they did not have a connection to the grid as none of the households were using solar energy in the Urban District, according the Household Budgetary Survey 2009/10 (The United Republic of Tanzania, 2012, pp. 67). In consideration of the number of available data, the monthly electricity payment was used as a proxy variable for affluence of the households. The data for monthly payment for mobile phone was not usable as the distribution of the households concentrated in the range between Tsh 0 and 500.

The percentage of the households with employed or self-employed householders was 48 percent, including the job such as civil servant, fish seller, technician, contractor, teacher etc. Agriculture was not the major income generation activities in Makadara as the composition of farmers was just nine percent. No households had large livestock such as cattle, goat and

sheep. Agricultural activities in Makadara were limited to domestic poultry or small-scaled garden faming. Watering of the garden was not common in the area.

Service hours varied among the households. Average service hours are shown in zone-wise in **Figure 4-8**. There were significant differences in the availability depending on the zones. Zones located at the eastern part of Makadara (B3, B4, A1, A2, A3) had shorter service hours while the households in the western part (B1, A6, A7) had service hours more than eight hours. Leakages from the pipes were considered to be the reason of this situation. In Makadara, there were three main distribution lines running from the north to south in parallel. According to ZAWA, pressure of the line laid under the eastern part of Makadara was low due to high leakage in the upper stream of the pipelines. Another large leakage was also observed in the same pipeline at the location between the A3 and B4 zones during the observation. Although the water pressure was low in some areas, only four percent of households were using booster pump to pump up the water in the elevated household storage.

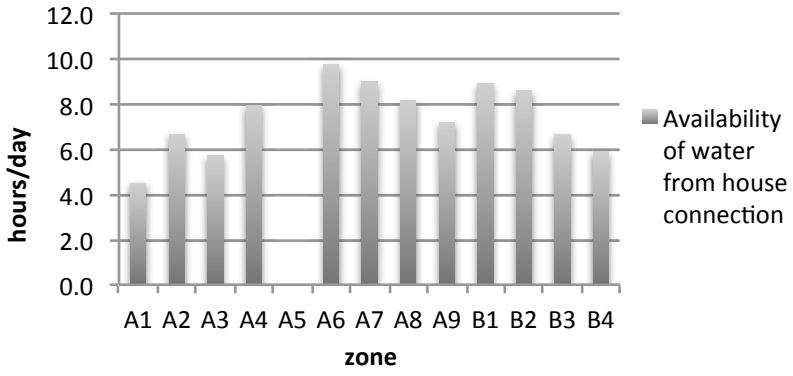


Figure 4-8: Average service hours zone-wise

Picture: Leakage from the pipe creating a stream at eastern zones in Makadara

There was existence of 14 percent of households who were sharing the water with the disconnected neighbours. Most of the households who were sharing the water with neighbours answered that they share water with one or two households. According to the interview, traditionally, there is a mutual helping culture in the region and people cannot refuse the neighbours who are asking for help (Result of interview: Code I3).

When the households were asked about their perceptions to ZAWA's services, 47 percent of them answered as "very good" or "good" and 52 percent said "fair". However, when they were asked about requests or suggestions on ZAWA's services in the open format (multiple comments were allowed), it revealed that most of the households were requesting for better services and lower tariff (**Figure 4-9**).

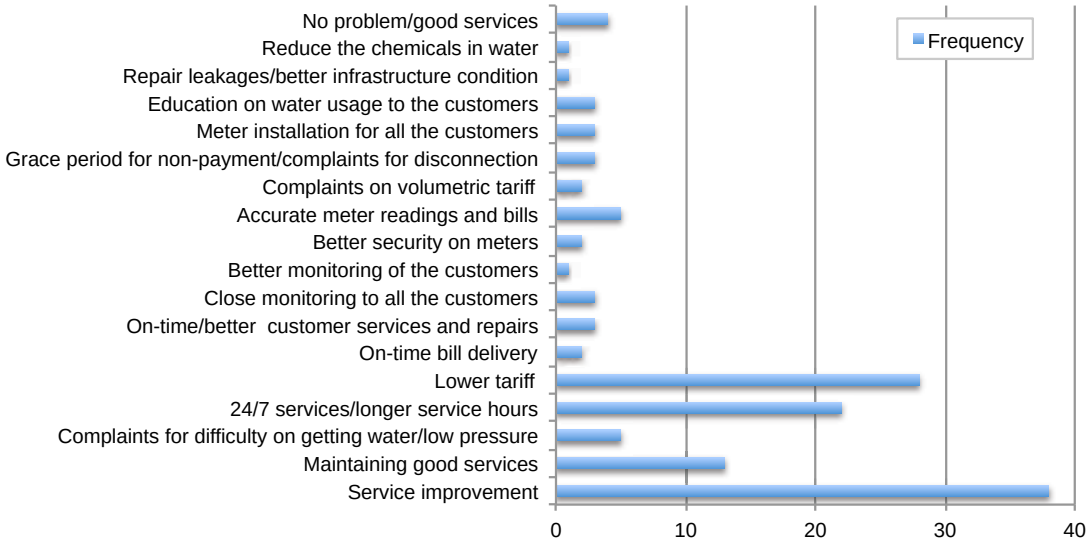


Figure 4-9: Result of the open question on requests and suggestions to ZAWA's services

Figure 4-10 shows the usage of alternative sources. Most of the households were using the water only from ZAWA. Six percent of the households were using the water pumped up from the well or water from the public standpipes. Nine percent of the households were using the rainwater. Water from the well and public standpipes were used for drinking and cooking,

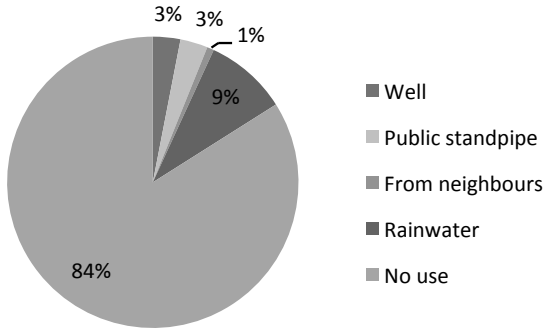


Figure 4-10: Composition of alternative sources used in Makadara

whereas rainwater was mainly used for washing dishes and clothes. Information on the frequency of using alternative sources was not obtained in the questionnaire survey.

In the questionnaires, 60 percent of the households answered that they did not know the month when the tariff has changed to the volumetric tariff. There were 55 percent of the households who changed to volumetric tariff in November 2010. Since they were the first group to change the tariff, they had been informed clearly about the introduction of the tariff from that month. However there is a possibility that the households who changed the tariff after that were not informed properly about the month of shifting to the new tariff. Billing records indicated that those customers were charged based on the volumetric tariff after few months from the installation of meters.

- ***Changes in Water Consumption by Introduction of Volumetric Tariff***

Figure 4-11, **Figure 4-12** and **Figure 4-13** shows the means, standard deviations and distributions of three types of water consumption data: water consumption of the month when the volumetric was first introduced (month n=1); annual average of the water consumption after six months from the introduction of volumetric tariff (month n=7-18); and differences in water consumption from the first and second types of water consumption data. Comparing the first month and the average consumption after six months, distribution was positively skewed in the first month but it became almost normal in the average consumption. The peak of the distribution was around 10 cubic metres in the first month whereas it shifted to around 13 cubic metres in the average consumption. The average water consumption after six months from the introduction of volumetric tariff was 13.3 cubic metres. In average, monthly water consumption had increased for 1.4 cubic

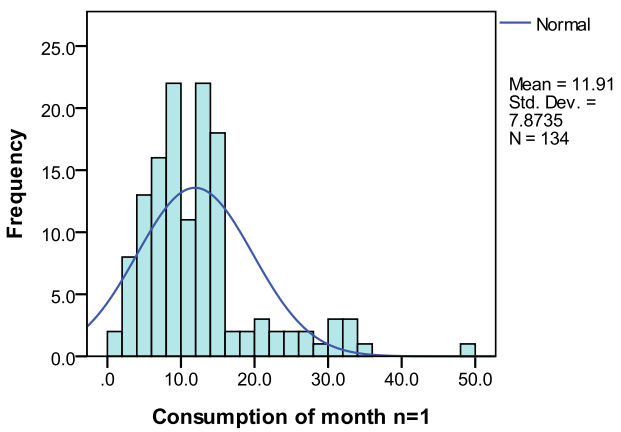


Figure 4-11: Histogram of water consumption in the first month of introduction of volumetric tariff

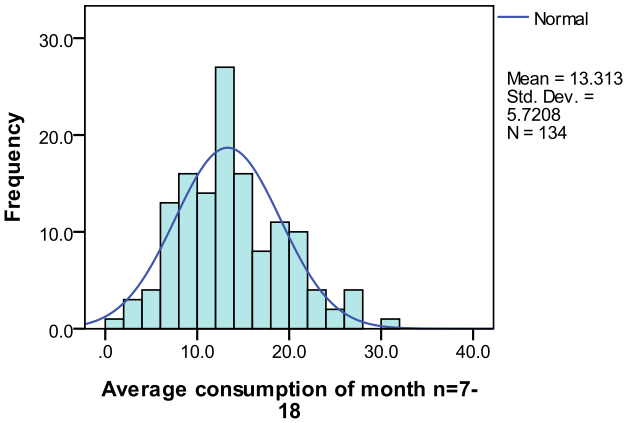


Figure 4-12: Histogram of annual average water consumption after six months from the introduction of volumetric tariff

metres (11.8 percent increase) from the first month. However, the distribution of the differences in the water consumption illustrates that there were both increased and decreased cases. (The positive consumption indicates the decrease and negative indicates the increase from the first month.)

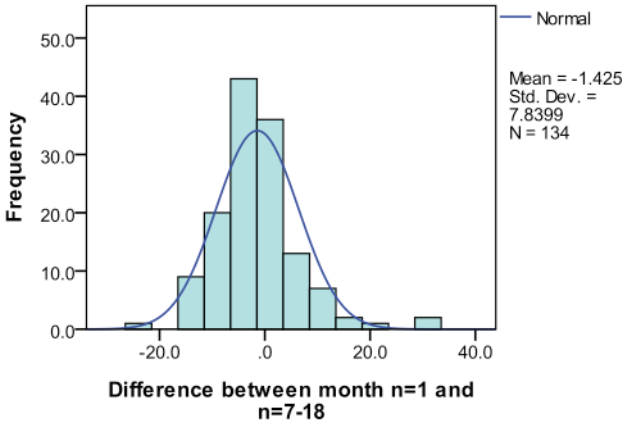


Figure 4-13: Histogram of difference in water consumption between the first month of volumetric tariff introduction and annual average after six months from introduction

Pearson's correlation coefficients among the three types of water consumption data are shown in **Table 4-6** and the corresponding scatter plots are shown in **Figure 4-14** and **Figure 4-15**. Correlation coefficient between the consumption in the first month and average consumption was 0.37. The correlation was stronger when analysed with the differences in water consumption as it was 0.73. Both of them indicated the statistical significance at 0.01 level. Homoscedasticity of the relationship was stronger in the scatterplot of the consumption of the first month by the differences in water consumption. Except four households, all the households who were consuming more than 15 cubic metres in the first month had decreased the consumption. These results clearly describes the tendency that the households who were consuming more under the fixed rate had decreased more after the introduction of the volumetric tariff. The result was matching with the typical water demand curve as well as the interview results that some households were surprised to see their high water bills after changing to the volumetric tariff and then they reduced their consumption afterwards (Interview: Code I3).

Table 4-6: Correlation matrix for different types of water consumption data

		$Q_{n=1}$	$Q_{n=7-18}$	$Q_{n=1} - Q_{n=7-18}$
$Q_{n=1}$	: Consumption of month n=1	1.00		
$Q_{n=7-18}$	: Average consumption of month n=7-18	0.37**	1.00	
$Q_{n=1} - Q_{n=7-18}$	:Difference between month n=1 and 7-18	0.73**	-0.35**	1.00

** Correlation is significant at the 0.01 level (2-tailed)

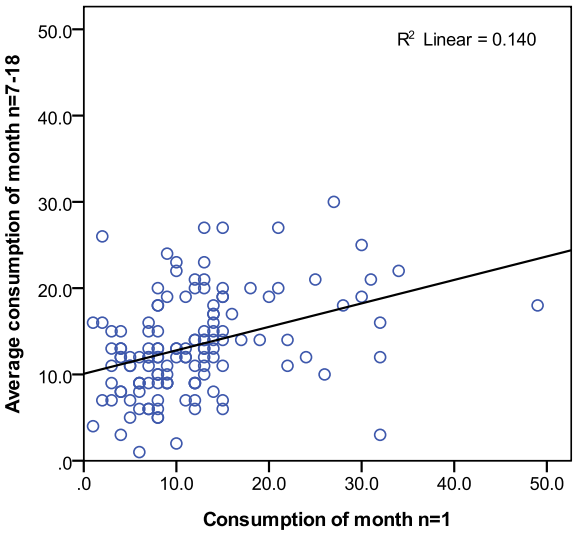


Figure 4-14: Scatterplot: water consumption of the first month of introduction of volumetric tariff by annual average water consumption after six months from introduction of volumetric tariff

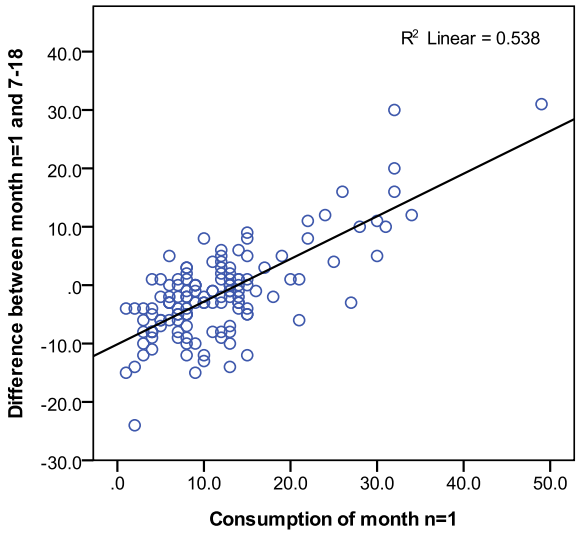


Figure 4-15: Scatterplot: water consumption of the first month of introduction of volumetric tariff and difference in water consumption between the first month and the annual average after six months

On the other hand, the scatterplots also illustrates that the most of the households who were consuming less had increased their water consumption after the introduction of volumetric tariff. These results suggest that the unnecessary water consumption used by the high consumers was reallocated to the households who did not have access to the sufficient amount of water and led to the slight increase in the average water consumption.

- ***Determinants of Water Consumption***

Determinants of water consumption were examined by the recent average water consumption and household data collected from the questionnaires. **Figure 4-16** shows the mean, standard deviation and the distribution of the average water consumption data from the period of October 2013 to April 2014. Mean was 13.5 cubic metres and the normal distribution was observed in the histogram. This characteristic of the water consumption data was almost same with that of water consumption after the six months from the introduction of volumetric tariff (**Figure 23**).

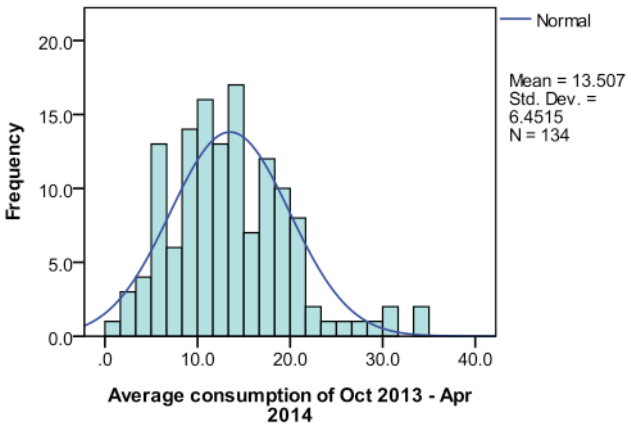


Figure 4-15: Histogram of average water consumption from October 2013 to April 2014

Out of six independent variables selected as the result of the literature review and fieldwork, four of them were interval data and two of them were nominal or ordinal data. Descriptive statistics for the variables collected in interval data are shown in **Table 4-7**. Means and medians of the variables were almost the same except the data for the monthly electricity bill, which the positive distribution was observed in the **Figure 4-7**. Statistics of the variables collected in nominal or ordinal data are shown in **Table 4-8**. It shows the unevenly distributed samples in each category of the variables.

Table 4-7: Descriptive statistics for variables collected in interval form

Variable	Unit	Frequency	Mean	Median	Standard Deviation	Minimum	Maximum
Average consumption from October 2013 to April 2014	m^3/month	134	13.5	13.1	6.5	1.6	34.9
Service hours	hours/day	133	7.2	8	2.9	1	12.0
Household size	n	134	5.8	6	2.7	1	15
Monthly electricity bill	Tsh	134	11,746	5,000	14,093	0	70,000
Number of children in the house	n	134	2.2	2	1.9	0	10

Table 4-8: Descriptive statistics for variables collected in nominal or ordinal forms

Variable	Category	Frequency	Percentage
Usage of alternative source	Use	23	17.2
	No use	111	82.8
	Total	134	100.0
Water pressure	Very low	0	0.0
	Low	4	3.3
	Fair	81	65.9
	High	23	18.7
	Very high	15	12.2
	Total	123	100.0

Correlation coefficient was calculated for the independent variables collected in interval data as shown in **Table 4-9**. Correlation coefficient was 0.18 with statistical significance at 0.05 level for household size and 0.32 with statistical significance of 0.01 level for the number of children in the house. Scatterplots of these two variables are shown in **Figure 4-17** and **Figure 4-18**. Positive relationships were observed for both independent variables. Usage of water consumption was significantly higher in the households which accommodate more children.

Table 4-9: Correlation coefficients (independent variables in interval form)

Dependent variable: Average water consumption from October 2013 to April 2014	Correlation coefficient	Significance
Service hours	0.03	0.74
Household size	0.18*	0.04
Monthly electricity bill	0.10	0.27
Number of children in the house	0.32**	0.00

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)

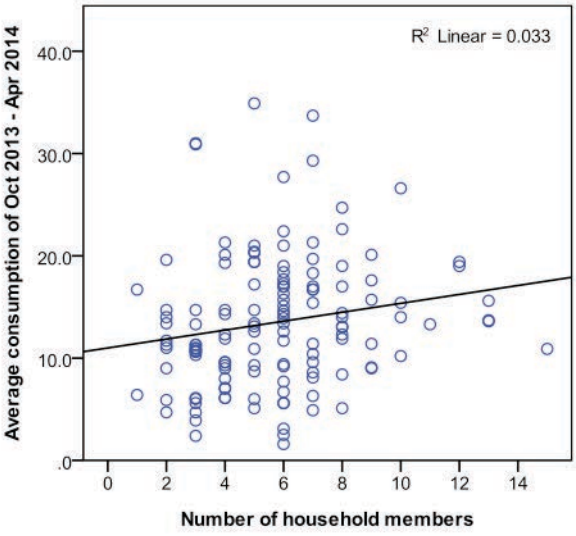


Figure 4-17: Scatterplot: Number of household members by average water consumption from October 2013 to April 2014

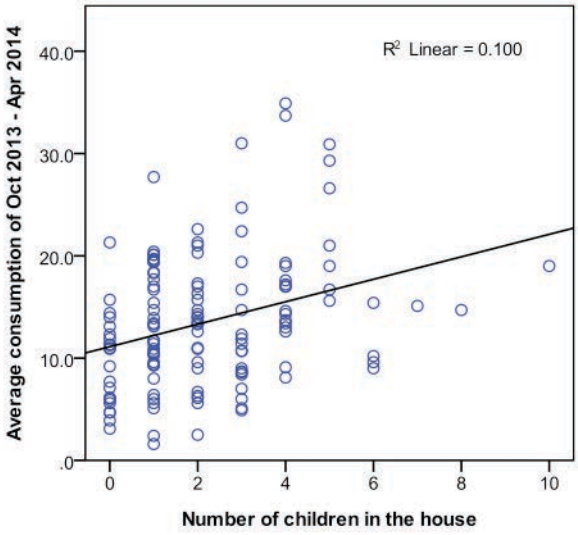


Figure 4-16: Scatterplot: Number of children in the house by average water consumption from October 2013 to April 2014

Independent variable for electricity payment and service hours did not show the correlation with water consumption. There are two hypothetical reasons for these results. First, there is a possibility of Type I error in setting the electricity payment as proxy variable for affluence of households. Second, households might be limiting their water usage for basic domestic purposes with high marginal values and thus water consumption was less sensitive to either the affluence level or the service hours. This can be supported by the facts that the average water consumption of 13.5 cubic metres (approximately 77 litres per capita per day) was not high for the consumption in urban water supply and the normally distributed household water consumption after the introduction of volumetric tariff.

Analysis of variance was conducted for nominal and ordinal independent variables. The result is shown in **Table 4-10**. The analysis did not show the significant differences between the groups. One of the possible reasons for this result is the unevenly distributed samples in each group. For instance, 82.8 percent of the households were not using alternative source and accordingly, variance of samples within that group was much larger than the other group,

which was not the ideal condition for ANOVA. Another possible reason, especially for water pressure, is that households' answers might not be demonstrating the actual situation due to their tradition of not selecting the negative answers in the ordinal question in the questionnaire. Despite the fact that only four households answered that the water pressure was "very low" or "low" in the questionnaire, many households were requesting for the longer service hours or complaining about the low water pressure.

Table 4-10: Results of analysis of variance (independent variables in nominal or ordinal form)

Dependent variable: Average water consumption from October 2013 to April 2014		Sum of Squares	Degrees of Freedom	Mean Square	F-ratio	Significance
Usage of alternative sources	Between groups	59.4	1	59.4	1.43	0.23
	Within groups	5376.4	132	41.5		
	Total	5535.8	133			
Water pressure	Between groups	41.3	3	13.8	0.35	0.79
	Within groups	4751.1	119	39.9		
	Total	4792.5	122			

4.4. Discussion

Water tariff should satisfy revenue sufficiency, economic efficiency, equity and poverty alleviation in the context of water supply services in the developing countries. In this section, effects of volumetric tariff on water consumption in Makadara were discussed in the light of these four objectives of water tariff.

First, with regard to revenue sufficiency and economic efficiency, contribution to the coverage of operational expenses was examined. As the result of the analysis on water consumption, the average consumption increased from 11.9 cubic metres to 13.3 cubic metres after the introduction of volumetric tariff, which was increase by 11.8 percent. The average water consumption of 13.3 cubic metres can be converted to Tsh 4,190 by using the introduced volumetric tariff and it was five percent higher than the fixed rate. If this percentage is applied to the collected revenues from the domestic customers in the financial year of 2011/12, increase in the total operating revenues would be only two percent and the ratio of total operational revenues over total operating costs just changes from 0.23 to 0.24.

The results imply that only the transition from the fixed rate to volumetric tariff would not be the effective solution for improving the revenue sufficiency or economic efficiency. For increasing the operational revenue, improvement of bill collection efficiency is much stronger than the introduction of volumetric tariff. **Figure 4-19** shows the collection efficiency for the metered

customers after the introduction of volumetric tariff. The ratio was 74 percent just after the introduction of volumetric tariff in November 2010, whereas it decreased after the increase of metered customers in April 2011. The reason of the improvement in the ratio in September 2011 was the disconnection campaign carried out in the same month. The result illustrated that the operational revenue largely depends on ZAWA's effort on bill collection.

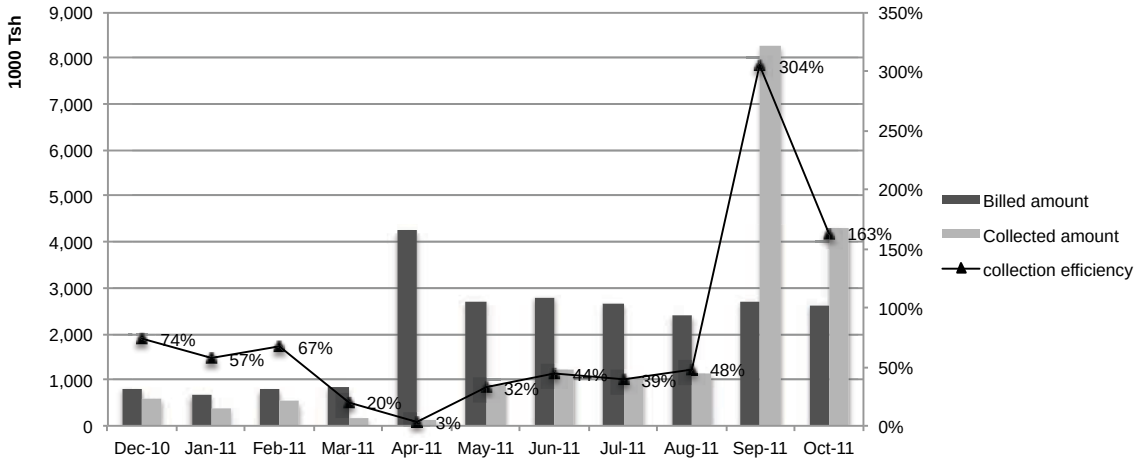


Figure 4-18: Collection efficiency from the metered customers in Makadara (December 2010 - October 2011)

(Source: Adopted by ZAWA)

With respect to the price of tariff, it was never too inexpensive comparing with the income level. The average water charge of Tsh 4,190 was four percent of the average household income, which was exactly matching with the major principles adopted for designing the volumetric tariff in ZAWA. Additionally, the price of water was not low comparing with the electricity bill, as the monthly electricity bills were ranging around Tsh 5,000 per household. In this sense, it is not realistic to increase the water tariff for achieving the cost recovery.

On the other hand, there is a potential for reducing the operational expenses by introduction of the volumetric tariff. According to the result of the interview, water pressure in the area increased after the introduction of volumetric tariff. People who did not care about saving water changed their behavior to close the taps and accordingly, the households in the downstream of the network who were not receiving enough water became accessible to water supply services (Result of interview: Code I1 and I3). Introduction of volumetric tariff will contribute to reallocate the finite water produced by ZAWA. It could increase the water pressure without major investment on increasing the water production or repairing the leakage. In addition, domestic water metering also contributes to NRW reduction, which is an effective measure for reducing the operating expenses.

Picture: Tap was not closed when the customers were charged with fixed rate

There is no question about the improved equity by introduction of volumetric tariff. The customers were charged according to their own water consumptions based on the volumetric tariff. However, if it is considered to be fair to provide subsidies to the poor from the viewpoint of poverty alleviation, currently introduced increasing block tariff was not functioning at all in terms of cross-subsidies to the poor. The first block of the tariff was up to eight cubic metres but most of the households were using more water than the first block. Besides, the analysis on water consumption revealed that the large water consumers have reduced the water consumption after the introduction of volumetric tariff and most of the users limit their water usage only for the basic domestic purposes whatsoever their affluence levels are. If there is a need of cross-subsidy system to be incorporated in the domestic water tariff structure, changing the tariff to the volume differentiated tariff (VDT) is one of the options because the customers who use more than the first block would not be benefitted from the subsidized price. In addition, creation of third block which targets the large consumers is another option for cross-subsidy system. For instance, third block can be set for the customers who consume more than 20 cubic metres considering the distribution of monthly water consumption.

4.5. Chapter Conclusion

This chapter presented the results and analysis led by the employed methodology in this research. The situation analysis of ZAWA before the introduction of volumetric tariff demonstrated the drastic changes of ZAWA from the state control situation and assessed their

status comprehensively. The process of introducing the volumetric tariff was found to be challenging as there were disturbances from the political influence and unexpected power cut in the large scale. The descriptive feature of Makadara was presented and then effects of volumetric tariff on water consumption was analysed. The result was discussed from the aspects of required objectives for the water tariff in developing countries. These results were summarized as conclusion and recommendation in the final chapter.

Chapter 5. Conclusion and Recommendation

The dissertation is concluded in this chapter. In section 5.1, research aim and questions were revisited. Section 5.2 points out the recommendations led from the results and analysis of the research. Limitations of the research are noted in section 5.3 after reviewing throughout the research. Section 5.4 provides the suggestions for the future related research. Concluding remarks are stated in the final section, 5.5.

5.1. Revisiting the Research Aim and Questions

In order to investigate the effects of volumetric tariff on water consumption, ZAWA's experience on changing the tariff from fixed rate to the volumetric structure was studied. To comprehend the effects accurately, situation of ZAWA before the introduction of volumetric tariff and the process of introduction were analysed. Then the effects from the transition of the tariff structure were investigated by using the household water consumption data and household data collected through the questionnaires. The answers of the research questions are summarized hereinafter.

1. ***What was the water service situation of ZAWA before the introduction of volumetric tariff?***

ZAWA had developed their institutional structure from the state control situation and started the residential water pricing operation with monthly fixed rate of 4,000 Tanzanian Shillings (Tsh) in 2008. They made significant changes in their institutional set-up and tackled many challenges including system development and human resources development, legal adjustment for charging domestic customers, and raising the public awareness on paying for water. However, their water supply services were not reaching to the customers' satisfactory level because the water was supplied intermittently due to their aged fixed assets and immensely high physical water losses. The poor financial status clearly illustrated the needs for their service improvement. Operational revenue was covering less than 20 percent of their operational expenditures.

2. ***What was the process of introducing the volumetric tariff?***

IBT was enforced together with fixed rate in 2008, even though there were no metered domestic customers at that time. IBT contained the service charge of Tsh 600 and two blocks, which the prices were Tsh 250 per cubic metre up to eight cubic metres and Tsh 300 for more.

It was designed to charge slightly less than the fixed rate if the customers consume 12 cubic metres per month. The volumetric tariff was planned to be introduced from August 2009 in the original plan. The trainings for the staff, preparation of supporting materials and public relation activities to the customers progressed well based on their plan. However, their plan was adversely influenced by the unexpected reduction of the fixed rate from Tsh 4,000 to Tsh 2,000 by political influence and the nationwide power cut for three months due to the accident on national grid. Nevertheless, meter installation was resumed from June 2010 and volumetric tariff was first introduced in November 2010 to around 350 customers and increased gradually. The number of metered customers was around 750 in 2012.

3. What are the effects of volumetric tariff on residential water consumption?

After the introduction of volumetric tariff, most of the customers who were using water more than 15 cubic metres reduced their consumption and customers who were using less water increased their consumption. Consequently, average water consumption was increased by 11.8 percent. It is considered that the large consumers reduced their consumption because they were charged much higher than the fixed rate and accordingly, the conserved unnecessary water consumption was reallocated to the households who did not have access to the sufficient amount of water. This assumption is justified by following three results.

First, in the first month of introduction of volumetric tariff, households' water consumption was showing the positive skewness with the peak of around 10 cubic metres, but in the annual average after six months from the introduction, the distribution became normal with the peak of around 13 cubic metres.

Secondly, the result of the analysis on determinants of water consumption showed the tendency that the households with more household members, especially children, consume more water. Besides, the average water consumption was approximately 77 litres per capita per day, which seemed to be not high for the urban water supply situation. From these results, it is considered that the households were limiting their consumption only for the basic domestic usage, whatsoever their income levels were. Therefore, the statistical significance was only shown in the determinants related to the number of household members.

Thirdly, according to the result of interviews, water pressure became higher after the introduction of volumetric tariff. This situation happened because the customers started to close their tap to save water.

The research aim to investigate the effects of volumetric tariff on residential water consumption in the Urban District of Zanzibar was achieved by the presented answers to each research question. Under the intermittent water supply situation, volumetric tariff increases the

water pressure in the network by reducing the unnecessary water consumption and increases the water consumption of the households who did not have access to the sufficient amount of water by reallocating the finite water.

5.2. Recommendations to ZAWA

Recommendations generated from this research were noted for ZAWA to improve their water supply management. The following points are the recommended for ZAWA.

- ***Improvement of Bill Collection Efficiency***

The research revealed that the change of tariff from current fixed rate (Tsh 4,000) to volumetric tariff would increase the operating revenue from the domestic customers for five percent as the average payment for water was Tsh 4,190 in Makadara with the introduced volumetric tariff. If the revenue increase is calculated with the other customer categories, it will be only two percent. When it is converted into the ratio of operating revenues over total operating costs, it only changes from 0.23 to 0.24 by using the figures of financial year of 2011/12. Hence, changing from the currently used fixed rate to the volumetric tariff will not directly contribute to significant revenue increase. In order to improve the revenue sufficiency and economic efficiency, improvement of bill collection efficiency is much more powerful. Even in Makadara, collection efficiency was usually below 50 percent except the month of disconnecting operation. It is recommended to make more effort on improvement of bill collection.

- ***Dissemination of Volumetric Tariff***

Introduction of volumetric tariff will reduce the unnecessary consumption of water and reallocate water for the customers who need more water. Thus the introduction improves the equity not only from charging water according to the consumption but also by improving the equivalent services to the customers. It also contributes to reduce the NRW by metering the consumption. Therefore, introduction of volumetric tariff could contribute to the reduction of operating costs. It is recommended to promote the volumetric tariff to the wider area.

- ***Revision of Tariff Structure***

The currently used volumetric tariff design is IBT consists of two blocks with the boundary at eight cubic metres. If the function of cross-subsidy is expected in the tariff structure for the aspect of fairness and poverty alleviation, it is recommended to revise the tariff structure. Most of the customers were using more than the first block and any kind of customers could receive the benefits from the lower unit price in the first block. One of the options for enhancing the

cross-subsidy function in the tariff is to introduce the volume-differentiated block tariff (VDT), so that the customers who consume more than the first block will not be subsidized. Another option is to create the third block targeting the large consumers using water more than 20 cubic metres per month.

- ***Improvement of Meter Reading and Data Entry***

In this research, 200 samples were collected in the questionnaire survey. However, only 134 samples were usable due to many missing meter readings. Meters were supposed to be read every month, but due to the missing meter readings, customers were billed irregularly. It is recommended to read meters regularly and deliver the accurate bills in order to maintain good relationship with customers.

5.3. Limitation of the Research

Limitations in the research were summarized. Following three points were considered to be the limitations of this research.

- ***Obtaining Accurate Household Income***

Household income was attempted to collect from the questionnaire. However, most of the households did not answered due to the sensitivity of the question. Monthly payment for electricity was collected as proxy to show the affluence of the households but the study could not prove that it was matching with the income distribution. If the household income could be collected more accurately, the result on the determinants of income level could be presented more clearly.

- ***Non-availability of Annual Average of Recent Monthly Water Consumption Data***

The average water consumption for recent seven months was used in the analysis on determinants of water consumption instead of annual average. It was ideal to use the annual average to avoid the seasonal fluctuation in the water consumption. However average water consumption was not used because there were many missing data before seven months due to the upgradation of customer database.

- ***Interview to the General Manager of ZAWA***

General Manager of ZAWA was not interviewed in the fieldwork since he was hospitalized. However, this limitation did not affect the results seriously as General Manager was relatively new and the outcomes from the interview may not directly relate to the research questions.

5.4. Suggestions for Future Research

Reviewing the process and conclusion of this research, following points were suggested for the future research.

- ***Collection of Longitudinal Changes in Household Data***

This research analysed the changes in water consumption after the introduction of volumetric tariff and determinants of water consumption separately. The separation of analysis implies that there might be a potential error that the identified determinants might be not applicable to the situation in the past. If the household survey could be carried out twice: just before the introduction of volumetric tariff and after some period, it enables to take account of the longitudinal changes of household situation. Then, the analysis could demonstrate the situation more accurately.

- ***Analysis on Changes in Water Pressure***

This research identified the increase in water pressure after introduction of volumetric tariff from the result of interviews. Physical data collection on changes in water pressure before and after the introduction of volumetric tariff will enable to justify the findings from this research more strongly.

- ***Examination of Methods for Collecting Household Income Data***

Collection of the household income data should be carefully examined with consideration of the local situation. It is suggested to discuss the data collection methods with the local counterparts and pilot testing of the selected methods.

- ***Case Studies in Other Water Utilities***

The water was supplied intermittently in the case targeted in this research. If similar results can be led from other intermittent water supply cases, the results could be more generalized. On the other hand, if the situation of water supply is different, the results might be different. It is recommended to accumulate the results of other cases.

5.5. Concluding Remarks

When the research topic was decided, reduction of the total water consumption was expected. Eventually, the results suggested that the expectation was wrong. Literatures that dealt the transition from fixed rate to volumetric tariff are scarce, especially for the ones focusing the

situation of developing countries. On the contrary, immense population in the developing countries is still charged with fixed rate by water utilities. In such situation, it is inevitable for the water utilities to think about changing their tariff to the volumetric structure. In order to guide these water utilities, it is sincerely hoped that experiences of the utilities which are stepping ahead would be further studied and the lessons learned to be accumulated.

Picture: Customer meter installed for each household in Zanzibar

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Appendices

1. Checklist of the required secondary data
2. Interview guides
3. Transcription of interviews
4. Observation schedule
5. Questionnaire format (English)
6. Questionnaire format (Swahili)
7. Quantitative data used for water consumption analysis

Check List of Required Secondary Data

Required data	***Potential Data source***	***Corresponding research question***
Institutional set-up • National water policy • Legal framework • Institutional capacity (SWOT analysis, autonomy)	National Water Policy MKUZA II The Water Act Strategic Business Plan	Q1
Organizational status • Organogram (staffing of each post need to be confirmed through interview) • Organizational performance (SWOT, KPI)	ZAWA Strategic Business Plan	Q1
Human and financial resources • Number of staff • Training programme • External and internal financial resources	ZAWA Annual report	Q1
Water supply situation • Water resources • Infrastructure • Service levels	Project document (JICA, ADB) Strategic Business Plan	Q1
Cost recovery • Operation and maintenance cost • Service revenue • Investment plan	Annual report Financial statement Strategic Business Plan	Q1
Strategic plan • Mission, vision and goals • Action plan	Strategic Business Plan	Q1
Drivers for introducing volumetric tariff • Archival documents • Local news, etc.	ZAWA MLHWE	Q2
Legal adjustment • Legal document (bill for government gazette, etc.)	ZAWA	Q2
Process of designing a tariff • Archival documents for tariff design, etc.	ZAWA	Q2
Meter installation plan • Schedule • Number of meters and specifications • Maps • Supporting materials for installation • Directories for meters and metered customers • Information flow • Actual implementation schedule	ZAWA	Q2
Human and financial resources • Training programme and modules • Participation list • Financial document for purchasing meters, etc.	ZAWA	Q2
Public relation and information to the customers • Public relation materials and tools	ZAWA	Q2
Metered water consumption • Metered reading data of Makadara	ZAWA	Q3
Climatic data • Temperature • Rainfall	Meteorological Agency	Q3

List of Questions for Semi-Structured Interviews to **ZAWA General Manager**

Introduction of the research

Consent for recording the interview

Challenges on water services

1. What do you think about the current situations of water services?

2. What are the current challenges of ZAWA?

3. What do you think are the measures to overcome those challenges?

Progress of strategic business plan

4. How is the progress of the strategic business plan so far?

Impacts of water pricing

5. Do you see any impact of water pricing?
   - Internal
   - External (customers, politicians, higher authorities)

Future plans for water pricing

6. What are the future plans for water pricing?
   - Expanding the metering area
   - Revision of tariff
   - Increasing new customers
   - Public standpipes (e.g. changing to kiosks)

7. Is there any external pressure for water pricing?

8. What do you personally expect for water pricing?

List of Questions for Semi-Structured Interviews to **ZAWA Directors**

Introduction of the research

Consent for recording the interview

Water service situation before the introduction of volumetric tariff

(Internal situation)

1. When was the volumetric tariff first introduced by ZAWA?

2. How was the situation at that time?
   - Service levels (infrastructure, customer services)
   - Financial situation
   - Performance and motivation of the staff

3. Was there any change (progressive/regressive) since then?
   - Service levels (infrastructure, customer services)
   - Financial situation
   - Performance and motivation of the staff

4. What are the reasons for those changes?
   - Service levels (Investments? Trainings?)
   - Financial situation
   - Performance and motivation of the staff

(***External environment***)

5. Was there any change in the customers?
   - Perceptions
   - Bill payment
   - Others

6. Is there any pressure from the politicians/higher authorities?

7. Is there any change from the situation before?

Process of introducing the volumetric tariff

8. What was the driver for water pricing?

9. Was there any reason for introducing the volumetric tariff?

10. How was the tariff designed at that time? (procedure fore revision?)

11. What was the plan for meter installation?
    - Schedule
    - Number of meters
    - Coverage
    - Specifications for meter installation
    - Directories for metered customers
    - Information flow for meter reading and billing

12. How did ZAWA raise the fund for meter installation?

13. Was there any training conducted? (Contents? Who were the trainers and trainees?)
    - Meter installation
    - O&M of meters
    - Meter reading
    - Dealing with customers

14. What was the procedure for meter reading and billing?

15. Did it go well?

16. How did ZAWA inform the customers/other agencies about the volumetric charging?

17. How did ZAWA take consents from the customers for introduction of volumetric charging?

18. How did the customers react to the information?

19. How was the customers informed about the starting month of volumetric charging?

Code: I1

Mr. Rashid Juma Khamis

Chief Credit Control

26th May, 2014

So, you said you started working with ZAWA from 2010. How was the situation of water supply services at that time?

Rashid: In general, ZAWA was facing a lot of challenge, even though, we are stepping forward improving our system.

For instance, how did ZAWA improve the services?

Rashid: First of all, we improved the coverage. In some areas, there are no water at all, even though the network is there. We delivered our services to the new customers. So we extended our lines, improved the production. We tried to manage the leakage. You know, this is a crucial issue. So we tried to fix the leakage, as much as possible. So we faced a lot of challenge, but we are improving somehow. Even for the water condition, if you make consideration of the water before and this time, I think in average, water is more available at this moment rather than the previous situation.

So, there might be some investments for that improvement such as improving the production of water, extending the lines, etc.

Rashid: Yes, we are improving the production, extending the lines, expanding the reservoirs, both ground reservoirs and elevated reservoirs.

What about the financial situation of ZAWA? ZAWA has improved the services and started to collect the money from customers, by installing meters and even from unmetered customers.

Rashid: You know, the historical background of Zanzibar. Before, water was free. Then the government changed the model from free of charges to make the payment of water. So, in this transition period from free to some contribution from the water, there is a challenge. So, when ZAWA was introduced, most of the people did not pay for water. When the days go on, the people became aware on the payment for water. So the people come to pay, we give them education, through announcement, advertisement and other activities in order to promote the people to come and pay, willingness to pay. So step by step, people get something in their mind concerning water, “Why we need to pay for water”. So somehow, we are not advanced like other utilities in case of bill collection, but if you make the comparison between the beginning of ZAWA and up to this moment, the people will be aware that the ZAWA’s revenue is improving slowly and slowly, step by step.

How long did it take to make the customer aware to pay for water?

Rashid: It depends on the area. Normally in the urban area, the people are already aware concerning the payment for water. That is why, in the urban area, we already provide the education, people already have the knowledge on water, so now for those who do not want to pay, we make action of disconnection in order to enforce them to pay.

So you said, ZAWA provided education to the customers. What kind of education programme was that?

Rashid: The education programme we did to the customer was through the PRO, Public Relation Officers. We take Sheha of Shehia and go to the citizen and arrange a open meeting to tell about water: why we need to pay for water, situation of water, how water was produced from boreholes, pumping, through the network to the customer, cost is required. So we always tell the people, “Who bear the cost?” The water is there in the borehole, but it should be transferred to the customers. We use electricity. There is a long distance from the borehole to the customers. So you have to pay for these charges. You know the question from the customers? This transaction period from water was free and now they have to pay. Now the people have the questions. “Why? Water was free before. Now, why is the government asking us to pay for water?” The reason behind is, subsidies for water is a huge burden for the government. The government needs to invest for education sector, health sector and other treatments. So the government wants the customers to pay for water, not the payment, the government wants contributions in order to make the water utility to operate well. So at this moment, this is not a payment. It is a contribution for the services. So we tell our customers and all the citizens. All the citizens should contribute in the water sector in order to provide the water supply continuously. So there are daily operation activities and these activities shall be covered. And where shall the money come from? It shall come from the users. We tell the customers, why do you pay for clothes, why do you pay for rice, why do you pay for electricity, and then why you did not pay for water?

How is the customers’ perception changing?

Rashid: It depends on the area. In some areas, the customers fully agree. Yes, we should pay for water because electricity is one of the components for producing water. If you want water, you should get electricity to get water. The

people have the willingness for electricity but they did not want to pay for water. Electricity is one of the inputs to the water, so if you tell like this, people understand to pay for water. It is not simple to get water without paying for electricity. If my house is paying for electricity, why not ZAWA, ZAWA is paying for electricity. So the customers' contribution is for electricity and some minor maintenance. So in the area of the town, people agree but they are not willing to come to ZAWA and pay. So we use disconnection operation in order to enforce them to pay. In the rural, you know the life in rural is different from that in town. Most of the people in the town are enjoying the luxury life and they have the ability to pay for water. For the rural area, sometimes the people are not affordable to pay. Sometimes, income per day is less than one US dollar.

Can I clarify one thing? When you say urban and rural, the Urban District is completely urban area or is there some rural area in the Urban District as well?

Rashid: Urban District is fully urban. People in the Urban District are fully aware for the payment but the problem is they do not come to pay. Even if they have the money, they are not coming to pay willingly. So ZAWA should make the effort to follow which requires another cost for going to their house. This is the problem for the urban people now. For the rural people, some people are already aware but some are still not. Even this weekend, we are going to Bumbwini Makoba. People shouted, "Why do we have to pay for water?" They try to mobilize themselves to refuse paying for water. So we enforce them. There is a misunderstanding between ZAWA and the customers. When the other staff called me, "OK, Mr. Rashid, there is something wrong with this site. People refused to pay and they want to beat us." I told my staff, "OK stop the operation. Let's go again with the police." So sometime, education is needed. But for the other area, even though you provide education to the customers, they refuse. So we need to enforce them to pay. Because in the same street, in the same village, some people pay and the other people refuse to pay. In the situation like this, you should enforce the people who refuse to pay. If there is a area that all of the people is not concerning the payment for water, we need to provide the education. So for the area like some agreed but some do not, and intentionally they refute for paying water, we accompany the securities. And if they still do not want to pay, we make the disconnection.

You explained me about the transition from the free water to the water pricing. In case of introducing the meters to the customers, how do you introduce the meters to the customers?

Rashid: Always, if we want to install the meters to the customers, we first see the availability of water. Then we provide the education to them. Why we install the meters. Sometimes in the case of flat rate, if you install the meters, you can keep in touch at least twice in a month. One of the problems of the customer, if the customer can't see the ZAWA staff, they do not come to pay. But if they installed the meters, the staff should go to read the meter and then you must go back the customers to bring the bill. So the houseowner, they will be able to see ZAWA staff twice a month. At the time of meter reading and bill delivery. It makes the customers aware that they have the balance to pay for ZAWA. We try to provide the education regarding the advantage of the meters. Then some people first refuse, "Oh we need to pay a lot", but once we installed the meter, they say "This is good." For example, Tuaka, at the first time we installed the meters, they refused. "Why do we have to install the meters to our village instead of other villages." In Tuaka, there was a project for borehole drilling which directly serve water to Tuaka. So ZAWA wanted to measure the production and consumption in order to know the lost amount of water. Then, they agreed to install the meter. Even though initially they were not happy with installing the meters, when the meters were installed, the other unmetered customers started to claim that they also want meters to be installed. Because, in rural area, the usage of water is very small. In case of the flat rate, some people pay more than the metered rate. Sometimes, if you are away from your house for a long time, the customers do not have to pay for water for such period, but for flat rate, nevertheless you are in the house or not, you definitely have to pay. So people in the rural area become aware that metering is good. In Tuaka all of the customers agreed to install the meters. Sometime, people refuse but for the future they might agree. For instance in Makadara, the people agreed to install the meters, but then they started to say "Why only Makadara? Our neighbor Gulioni, our neighbor Hajitumbo, why are they not installing the meters?" But in consequence they agreed to install the meters. Even though there was a challenge in installing the meters. The people want all of the customers to install the meters. The people may say "OK, we need the meters but please install them to all the customers in Zanzibar."

In case of Makadara, they were first complaining about installing the meters. Why did they agree to install the meters? How did ZAWA explained to them?

Rashid: First of all, we conducted a survey in Makadara before installing the meters. Then we told them, we are going to install the meters. They first claimed, "Why are you installing the meters? Our bill will be high." We told them that this is a pilot area, we just want to look the trend of the metered customers. If this pilot area had no issues, we will install the meters to the other areas of Zanzibar even though for the time being we are installing meters to your house free of charge, but other places when the benefit of installing the meters are confirmed, other customers have to pay for the installation of meters. If you did not agree, we may select other areas, but you need to pay for installing the meters. So they said, "OK. We would be the pilot area, so that we could install the meters for free."

I see, meters were free for the customers in Makadara. When the meters were installed in Makadara, how long did it take to install all the meters? And how many meters were installed in Makadara?

Rashid: Meter was installed in 2009 and 2010, if I am correct. The project for meter installation initiated in Makadara. The end of 2009 and beginning of 2010.

Was it installed universally to the whole customers?

Rashid: For the time being meters were installed to all the customers. But there were other customers who did not install the meters at that time according to the local situation. For some customers, lines were not the same with ZAWA's, some of the houses were vacant, but we continuously tried to install the meters to those houses day by day. We took the record of the houses which did not install the meters. We go to install the meters everyday. At this moment the meters installed in Makadara are about 955 until today.

Do you know how many meters were installed initially?

Rashid: I do not have the exact number right now. Please give me time to provide the exact figures. I think there were 300 meters from ZAWA and the other meters from JICA, but I will provide you the right answer. There is someone called Bilali, who installed the meters in Makadara. He will give you the information.

As for the meter installation, do you have any specification for installation like where and how to install the meters, type of the meters to be installed and so on?

Rashid: I think there is a specification, but sometimes there is problem, we did not have manual for installation of manuals. We install the meters according to the situation on site. When ZAWA was established the customers were already there. People were already using the water. We took the customers from the Department of the government. So the pipe was already there and when we installed the meters, we had to see the situation on the site directly. The pipe is lying like this and this. Even when you go to the Makadara, you may face different way of meter installation. But what we concern is that meter should be installed in the safe place, we have the general recommendation on how to install the meters, and the staff who installed the meters, he should draft the way he installed in the format. But we do not have the particular meter installation manual.

For instance customers will receive the education programme and if they agreed to install the meters, someone goes to the house and install the meters. What are the procedures after that, for example, I think the metered customers have to be registered as metered customers in ZAWA.

Rashid: There are two things. The first one, there is the customer who has the flat rate. He is already our customer and he is already paying according to the flat rate. But they do not have meter. For the customers like that, we install the meters and take note of the meter number and enter it to the system. So we could shift that customer to flat rate to volumetric. In the system, they have the function to put the customer in flat rate or volumetric. So if you install the meter to the customer who is already registered to ZAWA, the second step should be changing the customer's status from flat rate to volumetric in order to command the system to regard the customer as volumetric rate user. For instance, I came back from the meter reading and if the customer has registered as volumetric customer, the system would be able to put the reading data. But if you install the meter and did not change the status of the customer to volumetric tariff, the system will no operate. When we enter the meter number, from that moment, the customer's status will change from flat to volumetric. Another case, if the customer was not registered at the time of meter installation, people come here to apply for the new connection. We give the instruction such as you need to pay for meter and it should be installed. For this case, we register the customer as volumetric tariff user from the beginning.

In the first case, when the customer was already registered with the flat rate, ZAWA should get consent from the customer for installing the meter, is this correct?

Rashid: It is partially correct. You know ZAWA do not go to single customer to install the meters, they install the meters in the whole area. We want to put the meter on this town, this street, and this village. So if you agree or not, you should install the meters. In case the people agree, it is very simple for us to take care of them. In case they disagree, we tell that there are only two options: get the water with meter or to cut off the connection. So there are cases that people agree although they are not happy.

For the agreement from the customers, the leader of the Shehia, Sheha is responsible for the agreement of meter installation? Who is responsible for giving consent for meter installation?

Rashid: What we do is to go to Sheha. We tell the Sheha. "We would like to go your Shehia to talk about meter installation. You are the local associate to the government. You are the local leader to help the government. Installing the meter is the task of the government. So we need your support in order to fulfill the government's responsibility." Sheha never refuses our order. We provide Sheha the proposed data and place for the open meeting for the customers to listen to us and make queries. The Sheha just help us to arrange the open meeting in Shehia. There is no need to get the agreement from Sheha. Facilitating the people in his or her Shehia is the Sheha's responsibility. Sheha invites the questions from the people to ZAWA. Usually there are lots of questions from people. We start to answer to the question from the people. Some might be satisfied with our answer but some may not because we answer according to the order from the government. There is no other way to answer. People might say, "Why do we have to pay for water?" and our answer might be "This is the order from the government."

In the meeting, ZAWA has to convince the customers to install the meters.

Rashid: It is not convincing them, but just giving them information. We come here to install the meter, so when ZAWA staff come here to install the meters, please cooperate with them and if you have any question or claim, please go to the customer office so that we may answer of resolve the issues. When we go to the site, people are already aware that ZAWA staff is coming. Their responsibility is to provide necessary information concerning their house and where they pipes are lying. We go to the plot of the house owner, some of the household might have the pavement. If you do not provide the necessary information, I have to dig out all the pavement. We need the information to decide where to install the meter. You know the problem is that there is no recording about the location of the lines. Only the sketch of the main line exists. For the service line, it is not easy to see them. We should cooperate with the householders. We need to investigate. When we installed the meter and opened the tap but the meter was not rotating, this means that there are unknown line to the customers. We need to install the meters correctly so that the all the water will pass through the installed meters.

When you change the status of the customer from the flat rate to the volumetric, do you change the status immediately after installation of meter?

Rashid: Yes, immediately. When we install the meter, we need to fill in the form. There is a sketch of how meter was installed. When we come back to the office, all forms will be submitted to the database section and on the next day, we shift the information in the system.

Installation will be done in the credit control section and then the registration will be done in the database management section?

Rashid: Installation will be done by credit control and reporting of the meter installation will be submitted to me. After submission of the reports I take all to the database in order to shift the customers from flat to volumetric rate.

It seems to be a systematic procedure. Was this system already in place when the meters were installed in Makadara from the beginning?

Rashid: Yes. The system was introduced when ZAWA was established. ZAWA started to use the SBM from 2008 around September.

Was there any training conducted for meter installation and meter reading, that are related to credit control?

Rashid: There were lot and lot and lot of trainings. There were training provided by JICA, internal training conducted by ZAWA, there were many trainings. Some time we went to Arusha to see how the people in Arusha are taking care of the meters. As for the internal training, we have the staff who already have the knowledge and skills of installing meters. We use those experienced staff for internal trainings. Those people were educated by JICA's assistance. We use them to educate the other staff. There are two kinds of internal trainings. One is taught in the seminar style training and the other is the practical training on site.

Do you also have the training for customer management? There might be some cases that the staff who install the meters have to know the skills to deal with the customers.

Rashid: Somehow, there is. But comparing with meter installation and other issues, the knowledge to manage or take care the customers might be a problem. The training was already done but sometimes, the knowledge for customer care might be a problem. You know some people might already have the sense of customer care but some do not care about the customers. They talk whatever they want to talk without thinking that they are the customers. There might be other trainings on customer care but it is not my responsibility. But I realize that we need skills for customer care. Customers always come to me and I have talk about their payment. We need to talk in good language even though we are not belonging to the customer care section. We have three sections in the Commercial Department, Customer Care Section, Database Section and Credit Control Section. Staff in the Credit Control should have the skill for customer care but I am not professionalized on customer care. My colleague should learn more about the customer care.

I think this would be my last question. Is there any important information that was missing from my interview?

Rashid: I think you covered most of the areas. We always face the challenges. We were talking about the transition from flat rate to the volumetric rate, but for myself, the transition from the free to payment what it is charged by flat or volumetric, is more challenging. Most of the customers, they want to get water free of charges. Many customers claims that we do not want to pay and this should be paid by the government. We always have many extra duties in such cases. In case of flat to volumetric, I think it is important to shift to volumetric from two reasons. The first reason is a financial reason. Most of our customers use a lot of water. But in flat rate, instead of paying 20,000 per month you only have to pay 4,000 per month. The rate is fixed. People with different consumption should pay according to their consumption. In the rural, people use only few water. They use water only for drinking, washing their clothes, cooking, not for the luxury uses. Whereas, in town they use water for gardening, washing cars, they have the flush toilet with 4000 per month. It does not make sense. The people in the town using water for their luxury uses are paying the same amount with villagers. For me, I think ZAWA should shift all the customers from the flat rate to the volumetric rate. Financially, if we install the meters, the people who use more should pay more. Another reason is coverage, availability of water depends on the pressure. If the people have

the flat rate, whatsoever the amount they consume they pay the same amount, this means the other people may lack from water. If you put the meter, we can restrict the people to use water wisely. So the benefit of the metering would be increase in coverage. There is a real example in Tabeta. In Tabeta, some people were getting water but some were not. We installed the meter to the people who were getting water and people who were not getting water. As a result of installing the meter, all the people in the area could get the water. Because the people who were wasting water tend to reduce their consumption and the pressure in the pipe has increased. I really appreciate the metering from those two reasons: financial and coverage scenario.

It is interesting that there is already a tangible outcome from the installation of the meters. Thank you for your suggestion that the transition from the free to payment is the most difficult part for ZAWA. I am sure that your observation is right. In my study, since it is difficult to collect the water consumption data while people are not metered, so I am comparing the metered and unmetered. However, I feel that I should include your observation in my thesis. Thank you very much.

Code: I2

Mr. Mussa Ramadhan Haji

Director Customer Services

26th May, 2014

Mussa: The price of water was reduced from 4000 to 2000 and at that time people were very happy saying “Now, at least the government, they see us, we are afford to pay.” Because many people were complaining that 4000 is too expensive.

So did you say that discussion was in the parliament?

Mussa: Yes, we call it house of representative in Zanzibar. It is same as a parliament. We are using different name. As for the members, we call them the member of the house of representatives.

I think at that time, the volumetric tariff was designed to be less than 4000 Tsh.

Mussa: From that time, we were supposed to use that tariff and the price was, when we consumed 0 to 8 m3, we have to pay 250 Tsh per m3 and we exceed we have to pay 300 Tsh per m3. And it was estimated that most of the normal common houses they do not exceed 8 m3, so when we charge 250, it means that at the end of the month, we charge 2000 to 4000, something around this amount. But it was not realistic, most of the house, they exceed 8 m3. Some of them were consuming more than 10 and 20. Because they did not care of water consumption. Most of the people did not care.

Who designed this tariff?

Mussa: It was under the support from JICA in the phase 1 project. Once after the completion of the grant aid project, and there was a capacity building programme here in order to enhance the capacity of the ZAWA staff to manage the water utility’s business.

I think the volumetric tariff was designed to be less than the flat rate tariff, so that people would be encouraged to install the meter, but unfortunately at that time, since the flat rate was reduced to 2000, so that people in Makadara started to complain about installing the meter.

Mussa: Yes, some of them were complaining. But once after installing the meter, we did not charge them at that time. We even made the water free for usage for certain period. After that, we tried to mobilize them to understand what the meter is, how it can be charged with meters, so after that we said to them, now we have to charge something from your consumption. Some of them they agreed with us and some of them they agreed to pay but not paying. If we are not paying, what is the next? What is the problem? Can we get something from ZAWA?

Meter was already installed but they were charged by the flat rate for a while.

Mussa: Even not charging them. It was free while we were mobilizing them. It was for the study purpose for the time being. It was only in Makadara and it was only very few households who had installed the water meters.

Do you know the number of the customers who installed the water meters at that time?

Mussa: 300 meters were under the JICA's support directly, but while the progress was continuing, we were not charging them, after the exercise of fixing the meters we started to charge them. ZAWA also they tried to make effort of increasing more meters from 300 up to more like we have in that site right now.

300 hundred meters were installed with the support of JICA and in addition to that,

Mussa: If the people consume from 0 to 8, it was about 2000, but if they exceed, we have to charge more than 2000. So it was reasonable if the people consume around this much. If you consume only 8 m3, we have to charge only 2000 but most of the houses they are not consuming only 8 m3.

So, the volumetric tariff was set almost equal to 2000 and not 4000. After installing the 300 meters supported by ZAWA, later on ZAWA made an effort to increase the number of meters and you said that ZAWA started to charge once after completing the installation of 300 meters. And gradually increased the meters to 800 or so.

Mussa: And also while some of the customers are not paying, we are not enforcing them to pay, but we are trying to mobilize them to convince them, "please pay, please pay." Some of them, they take 1 year, some of them take 2 years without paying any single cent to ZAWA. But we never disconnected them because we needed to understand how the consumption is, how the people respond, positive or negative, to see how we can increase the number of meters. After that we know that now the people are understanding what are going on. So it means that if you need the connection from ZAWA, you have to accept the conditions of payment and to be responsible that our meter is safe. Some of them, they try to break their own meters, and they say "Oh no, someone broke my meter, not me. Someone I don't know." If you broke the meter, it means you have to come back to the flat rate. After realizing that, we are consuming a lot of cubic meters, so it means that we have to pay a lot of money. So it means that if we go back, it will be reasonable, 2000 only. I will afford 2000. Whoever spent a lot of cubic meters in a month, something like this situation happened. We also observed that there are some problems of scrap dealers. Some scrap dealers, they take meters and they resell as the scrap by kilograms. Because the most of the meter came from Japan was made of brass, the body of the meter. So the people they were taking it and broke them and gears, and plastic materials inside and they took only the brass materials and they are selling them in maybe 5000 per kg. And maybe one meter had half kilogram, so it means from 2 meters you can get 5000. And most of these people, they were drug abused people. So they thought we need to inject drugs and we need to break several meters and we will burn it and we will sell them. But most of the areas, we replaced the new meters. The meters made by plastic materials. I will show you the samples. We replaced to the meters like this after realizing that some people are interested in the brass material.

Where are these meters manufactured?

Mussa: They are from Turkey.

Now, all the meters are this type?

Mussa: No, not all. Most of them are. We replaced most of the broken meters to this type. But in the some other areas, some people tried to make grills to protect.

After installation of the meters, the tariff introduced was volumetric. Meter reading has continued.

Mussa: People were trained how to read the meters, how to endorse the meter reading to the system, how to process the bills. These trainings were conducted under the phase 1 project under JICA. Before that, no one didn't know how to read the meters, how to fix the meter, how to process a bill, even the distribution of the bills.

If I understand correctly, in December 2010, there was a trial billing and that was the start of the billing. ZAWA started to charge the water by the volumetric tariff in December, and ZAWA started to collect the money by volumetric tariff from January 2011 based on the meter read in December 2010.

Mussa: Yes, December reading and processing the bill and collection started from the next month, it means collection started from January.

It could be said that people who installed the meters in Makadara, they were collected by the volumetric tariff for the first time in January.

Mussa: Yes. But it might be better to discuss with Mr. Kinyangi, because he is responsible for delivering the bill for the time being. I am sure that he will provide you the real picture.

Coming back to the flat rate. The flat rate was reduced to 2000 from 4000 in July 2009. But it has been gradually increased like it become 2800 in July 2012, and then in December 2012 it becomes 3500 and then in July 2013, it came back to 4000.

Mussa: I remember that from long time from 2008, even the minister he changed the tariff from 4000 to 2000, but the guidelines, the tariff did not changed, just they changed the tariff verbally. The document never changed. So we went to

the central government and say please give us the permission to charge again with the previous tariff. And the cabinet, the chairperson under the President, they had a discussion with us, to discuss how we can come back again to 4000. They agreed with us because of the need of paying the running cost and other charges. We should change the tariff, but how? The government they said please change to 2000 to 4000, but to our people, it could be difficult to charge them from 2000 to 4000 immediately. So please arrange something, may be installment, gradually increasing, maybe starting from 800 increase and 700 and finally 500, so 2000 to 2800 for six months, after six months we had to increase again to 3500 and then six months we increased to 4000. So from 2000 to 4000 we required 18 months including three terms. From December 2012, in January 2014, we finally came back to 4000. So I remember that the discussion started from November, so we started to implement that program from December 2012, after six months it was 3500 and after six months it become 4000. We can check the system.

Regarding the volumetric tariff, when did you change the tariff to the new one?

Mussa: The new tariff was introduced in March 2013, but we started implementation from this February, but only for commercial customers and institutions. For the domestic, we are not ready to start. So still we are using the old tariff. Because we fear that it may discourage the people to install the meter. When we use the new volumetric tariff, it will become so expensive comparing to the flat rate. So we need to encourage the people to install the meters. The government also supports us, “OK you have the new tariff, but please you have the plan to encourage the people to be ready to install the meters in their houses.” So it is better to increase the flat rate in order to not making the people confortable with the flat rate. So themselves they will ask you to install the meters, so after that you can increase the volumetric tariff gradually.

Currently the flat rate is 4000?

Mussa: Yes, and in the new tariff it is 667 for 0 to 8 m3. When the customers exceed 8 m3, we have more bands. Previously it was only two bands. There is even a band for more than 17 m3. At least we can introduce the first band of the new tariff. But for the commercial and institutional customers, it is OK.

Was there any change in the flat rate? Is it still 4000 in the new tariff?

Mussa: In the new tariff we do not mention about flat tariff because we do not need flat rate. We need to change now. We have to move from flat rate to volumetric tariff. We need all the customers to be metered. So all the customers who do not have the meters, we are using the previous tariff.

When you introduce the new tariff, the increase in tariff, how do you publicize to the customers?

Mussa: For commercial, we write a letter to them. For the domestic, we use the special or official speech by the Ministry. They will use the medias to inform the public. Like through TV and radio to announce officially.

Is it going to be the minister?

Mussa: Yes. And from that time, we are using the PR section to make the people remind. If the people come here, they will also be reminded. “OK you are coming to pay the tariff, but remember that we are going to change after six month.” So most of the people are well aware of the changes like, “Are you already changing the tariff?” “No, we still have one month.” When we announce more, the more the people react. So we are doing it silently. For this 4000, it is not a new thing; we are coming back to the previous rate. But people were enjoying the offer for four years from 2009/10. We are introducing that we are just coming back to the previous rate, people says “Oh, OK, no problem.” We are talking to the customers very easily to the customers, so that people will not react negatively. Because they know that when they miss water supply in your home, you have to make the supply from the vendors, which is too expensive. Maybe you have to spend 4000 in one day. So we can say “Why are you arguing about spending 4000 in a month? ZAWA is better.”

When you first introduced the water pricing in Makadara, at that time, since the water was free before and then you started to collect, I think there were many resistance from the people. How was the situation?

Mussa: The situation was like, “Why Makadara?” So we explained that, “This is an opportunity for you. The people of ZAWA chose you. When you install the meter, you will receive close relationship with ZAWA. Every time you can ask to the ZAWA staff what is going on, and we will visit to your place when you are missing the supply, we will come and resolve the issues immediately.” “And are you going to have a plan for the other areas as well?” “Yes, we have a plan but we are starting from here. After graduating from this study here, we will distribute to the other areas. Please be a good teacher for the other areas. People in the other areas may come to your place to learn.” Some people say, “Ok, that is good.” And many time we are visiting them, Japanese, people from the Embassy and JICA. They become happy with that. But some people feel disturbed and we are charging more and more. Other areas are not like this, they are charged by a flat rate. “Don’t worry, if you experienced earlier, it will be better. No one can escape from metering. It will be distributed to all the areas in Zanzibar. You are the first, you will experience for the first time. After that you can just enjoy. Because you have a lot of experience.”

I heard that the meters were provided free to the people in Makadara.

Mussa: Yes. Even now, when we are installing the meter in a bulk, we are not charging. We are charging for the new application for new connection. But when we choose the area for installation, we do not charge for the meters.

Thank you.

Code: I3

Mr. Mussa Ramadhan Haji

Director Customer Services

27th May, 2014

First I would like to start from the general questions and then I would ask about the process for installing the meters and introducing the volumetric tariff. Yesterday, we talked about the time when ZAWA first introduced the volumetric tariff and we confirmed that that was January 2011. At that time you said that you have installed the 300 meters funded by JICA and with that meters, ZAWA started reading, billing processing and collection. And gradually ZAWA increased the meters in Makadara. As for those meters, who purchased the meters?

Mussa: It was ZAWA in order to proceed the meter installation for the domestic customers.

Comparing to that time and this time, how is the water supply situation chaning in Makadara?

Mussa: From that time, most of the people were not aware what the meter is, but now most of the people are aware what the meter is. They know that the meters measures all the consumption of the meters per month. So it means that now the people at least try to regulate themselves to make sure that they are reducing their consumptions comared to the previous time and compared to the time with the flat rate. No body cared about the water usage with the flat rate but if you install the meter they are aware how to control the water usage in their houses. The water supply comparing to that time, now it is okay, because previously it was difficult from Saatini schemes, at least once a day we supply water but now we supply water twice a day in the morning and evening time. It means that the production at least improved from Saatini. Morning and evening time, from 11 and from 6.

Is there any water coming from Welezo?

Mussa: Very few. Most of the water was coming from the springs called Bububu. And there are new boreholes, we call them Chumbuni area. That boreholes it is supposed to improve the water supply from Saatini area in order to substitute the water from spring which production level is getting lower. The Welezo, the alternative pipeline coming to Saatini, but it would be difficult to supply enough water to Saatini. So most of the water from Welezo are consumed in the other areas.

Today I went to Makadara around 10:30 in the morning and water was still coming out from the tap.

Mussa: Yes, that water should be coming from the elevated tank of Saatini. That's why we are pumping the water from the reservoir to the elevated tank twice a day. And that elevated tank distributes water twice a day.

Comparing to time of free water, how is the financial situation changing?

Mussa: Financial situation is changing. Because most of the customers, they do not come below 4000. They are paying 5000, 6000, 7000 according to their consumptions. If we are charging them with flat rate, it means we are just collecting 4000 each regardless of their consumption. But now because of the consumption raise, depending upon their consumption, it means most of the people they are paying more comparing to the flat rate charges.

Most of the people are paying more than 4000 right now.

Mussa: Yes.

OK. Where there any changes in your staff?

Mussa: Yes our staff is changing their attitude, capacity, working environment is also changing, and their salary is also changing from December last year.

Why did you change the salary?

Mussa: Because we needed the people to work hard. It will be difficult to work with very small salary. And people to be self motive to perform in their task. At least, when you make the motivation to the people by using salary, good environment with some facilities, it will attract them and also there is a competition among the staff. For some staff they moved away from ZAWA and finding another organization because of small salary provided by ZAWA. For that reason, we have to retain our staff with sufficient salary.

Is it possible to say how much amount of salary was raised? I think it depends on the staff though.

Mussa: Based on staff's experience, education and their designation, the salary depends. When we meet the Chief of the Human Resources, we can ask about more details.

Since you increased the salary, you need additional financial source for that. How did ZAWA generate the budget?

Mussa: Of course we tried to increase our revenue first. So that is why we promise our staff, when we reach certain revenue, we will give you back in salaries, so people try hard to reach certain target. May be ZAWA management can give us some rewards such as salary.

Does it means that ZAWA is setting the target of the revenues and monitoring the actual revenue collection?

Mussa: Yes, when I came here, the revenue per month was about 40 to 60 million, but nowadays we are reaching 200 millions. We try our best. We try to be together with our staff.

Are you monitoring the monthly revenue?

Mussa: Yes, every month we have to monitor the monthly revenue. And we have a system here. It means that all the records and daily records can be seen in the database.

Does the financial section manage the system?

Mussa: Yes, financial section manages the accounting system. Chief accountant and director of the financial department manage it. For myself, my duty is to make sure that the revenue is coming in and see the report, like for today at least we received this amount. We need to make the effort to make sure that we are increasing the revenue. The software are managed together, the financial department and me. All of us are responsible for monitoring the revenue.

Every month accounting system shows that this amount of revenue is collected and the report would be sent to you.

Mussa: I am responsible to make the report to the board of directors. Every quarter, we have progress meeting to the board of directors to make sure that all the progress concerning the revenue collections we have to report to them. And to the management, every month we should submit the report to the DG. We have to show the spreadsheet to show the revenues according to the categories we have in ZAWA.

How is the reaction of the board members?

Mussa: Most of the time they kick me, do your best, do your best, do your best! Just we are seeing you. Only you. Then we have to follow others. But first, we are seeing you. So that my responsibility is so big to make sure that the revenue should be increased. From revenue we have to do so many things. But we don't have money. Even the board of directors they come and see me to make sure that we have the alternative techniques for collecting more money in order to purchase equipment, facilities, tools, repairing and pipelines etc. Without money we cannot do anything. Even salary, for the motivation to the staff, some people may working overtime. We need to pay some incentives to them. But without the money, we cannot do anything. That is a problem. The board of directors, all the time they shake me.

I am not sure but ZAWA should be increasing the revenue as you started collecting the money. From those results, the board of directors are happy or they are saying you need to collect more revenue.

Mussa: They are little bit happy but they say this is not the end of our journey. We have to move from here to somewhere. That was the statement from the board. They are happy but they say we are not allowed to cerebrate this. We have to make the strategy how to move ahead from here. But sometimes they say congratulations for your teamwork, your effort, your improvement. But this is not your objective, you need to move more and more forward.

So the ZAWA's management is strictly monitored.

Mussa: Yes. That's why most of the time, I am not happy.

How many board members are there in ZAWA?

Mussa: There are five: chairperson, DG and other three and one secretary.

Are they from the government?

Mussa: Chairperson is appointed from the president. Members are appointed by the minister who is responsible for the water. DG is also a member. One secretary from ZAWA who is legal officer of ZAWA. This is according to the Water Act.

The current chairperson, is he a politician?

Mussa: It depends on the opinion of the President. Sometimes, politician, sometimes who has technical background, sometime from the government. But the good opportunity we have, now it is the second tenure, the chairperson is coming from the central government. Also she is the director of one department in the government. Some other directors are politicians, retired politicians, but this chairperson is very young, like me. Some of them are quite old, such as former Minister of Finance. Chairperson is very strong. One member is a lawyer from one department for housing and DG is very strong as well. One member is a 100% politician.

In some cases, politicians intend to reduce the tariff to make the voters happy. But in your case, the board member who has the political background is not saying to reduce the tariff?

Mussa: No, because she understands what is going on. Why the tariff needs to be increased. But the other politicians, they do not know the situation in ZAWA. They say it is better to reduce the price. But the one who is with us, they know our environment what we are facing, our entire challenges, they never say reduce the tariff. Even this tariff, it is not a small amount comparing to the other countries, maybe from utilities in mainland, other countries, Uganda, Kenya. Still our tariff is cheaper than the others. But maybe for our people, they were relying on the free water for a long time. But in mainland, they know that water is not free. They are paying for about 14 years. But here it is only 5 years. Maybe after this generation is gone, the new generation may understand that the utility will never supply water in free of charges. Now we are in the transition. Some of them, they agree with us, they know about us, maybe after 5-10 years, no one would complain. So the people can complain that the service is not fulfilling us, it is not promising, so please do your best because we are paying for water. This would be the future case. Now some of them say yes, some of them say no.

Now is the biggest challenge, free to pricing.

Mussa: It is the biggest challenge. But in the near future, the new director may enjoy the situation, but now we are not enjoying. Once I was appointed to be a director here, “Oh this is the nightmare. Many pressures. But after 5 years, when someone is appointed to ZAWA, Oh wow! I’m going to be a director of ZAWA.”

I think it is good that you have a supportive politician in the board member. What about the customers? How is the perception from the customers?

Mussa: You know, the people in Zanzibar, they are just neutral. They are waiting for someone to say something. They always need a support from someone. They are influenced to the group of politicians or some others. They can easily agree with something without having analysis or considering in depth. Like, Mr. X is coming from this political party, that party is my party so if Mr. X say something like this, we can accept. Maybe in UK, people may see some debate on the TV and say this is a good point and this is not, but here it is different. Here there is a two big political parties. CUF and CCF. Who said this, it is CCF. So CUF guys would say, “no, no, this is not good.” People are always influenced by someone. Most of the time, they are influenced by political leaders.

When you start collecting the money from customers, they might complain about the charges. Did you have many complains from the customers?

Mussa: Yes, some of them said “Please, ZAWA, do your job. But first improve your services.” Some said, “You have to wait for all the areas in Zanzibar to be supplied with enough water, then start collecting some money. But don’t come to collect money if someone is not getting water.” And then we asked them, “Do you know when we can supply potable water to all the citizens in Zanzibar?” “We don’t know.” “So it means that you also have to make effort for the others to get water. So please, contribute first and then we can extend our network to the others who are not fulfilled right now.” Some of them agree and say let us contribute. Some of them say we are getting water but not for 24 hours. Why are you here to collect the money? Please wait until you supply water for 24 hours. But is you are giving us rationing water, we cannot contribute for water. So we are trying hard to provide more water.

Once they started to pay, ZAWA changes from flat rate to volumetric tariff. Was there any complaints or comments from the customers?

Mussa: We tried to convince them. We had technical phrases. When we install meters to your house, it means that we have to reduce the number of complaints from their side. How? When we install the meters, it means that some days you are not getting water supply. It means that meters would not detect anything. But when the meters rotate, it means that you need to contribute. But if you are using flat rate, even if you are not getting supply for some days, we could not know how many days water is not coming to your house. So you have to contribute regardless of your water consumption. But if

you install the meter, it means that the meter can only reflect the amount you consumed. Some were saying, “This is fantastic! Please come to fix the meter in my house.” So that was the techniques we had to use to them. But after fixing the meter, they realize that they consume a lot of water. They say “How can we reduce the bill?” “If you need to reduce your bill, reduce your consumption.” “How?” “Monitor your consumption. Maybe there is leakage in your toilet, taps, kids might be playing with water.” Some of them they tried to reduce the consumption. And actually, they reduce the consumption. We know that when we fix the meters, it is obvious that most of the people realize that they are consuming a lot of water. And the tariff will be higher. And they try to reduce the consumption. Also they realize that there are no free water to be consumed and we have to pay. Most of the people, they are very careful on the electricity. But people don’t care about water. But after fixing the meter, they care about both electricity and water. When we fix the meter, even the pressure increases, because when we control the usage of water it means that water supply in the neighbours will improve because people start to close the taps. Without the meters, some people they go to bed without closing the tap. When you visit around, even in Makadara, you can see the river there, water comes from the drains because no one care. But when you fix the meters, you will not see such a situation.

Was there any change in the payment of the bills? Is there linkage between metering and bill payment?

Mussa: Well, there should be a linkage because when you consume more, then the meter will rotate frequently. It means that your bill will be very high, especially if you compare with the other who are controlling their usages. It means that people become aware that they should control the consumption, if there is no necessity of using water, they have to stop it. Because they fear the bill at the end of the month.

Were there any case like people could not afford the bill because the bill become too expensive?

Mussa: Yes, some of them. In such cases, we had to disconnect them. And they ask the neighbours. Please help me to pay for water supply. Some of them try to cheat us, by bypassing the meter. They tamper the water to avoid the meter to rotate, especially in the midnight. Even in Makadara. We sometimes detect such cases and impose the penalties. But some of them we need to disconnect for long time. They never come to reconnect again. Where are they getting the water services? Some of them are going to the public taps, some of them are knocking the doors of the neighbours. According to our traditions, there is a mutual helping culture. This is the situation in Zanzibar. To stop or reduce these cases, we need to install the meters to all the houses. Nobody can invite neighbours to their house to take water because they would know that their meter will rotate for giving water to the neighbours. This is also a big challenge according to our traditions. And the neighbours also fear from not accepting the neighbours to get water from their house, because the neighbours might feel negatively if we did not share the water to them. Maybe when I face a problem, who can help me. Because we are always living for helping each others. Sometime we don’t have enough sugar in my house. Can you give me some sugar for my tea. Don’t worry, take it. Sometime, it can be food, fish, salt. Can you help me? This is our culture. Even for the water, I don’t have a tap in my house, can I put my flexible pipe from the door? Oh no problem! This is the situation. So when we install the meters, how to manage the neighbours who does not have connection without breaking our friendship is also a problem.

Today, when I went to Makadara, I saw many boreholes with pump that lift up the water to the elevated small tank and supplying water. Is there any kind of regulation for drilling boreholes or abstracting groundwater?

Mussa: We have regulations but the problem is that it was introduced too early to the public. Now in the previous time it was free service, so the political leaders, they used this water for tools for getting votes in their areas. It means that they took the opportunity of shortage of water and they thought it is a good idea to dig the boreholes in the areas. But those boreholes are always in temporally use. After two three years, boreholes will dry up. It is very shallow. Water is not safe at all. And we also make sure for them to come to our office when they drill the boreholes for giving them instructions. We have to register all the boreholes. But most of the people they avoid this because they will be charged. 50,000 for domestic borehole. You can find it in our new tariff. But we are not so strict in that area, because we know that we have shortage in our water supply. People should have alternative sources. And people are still not understanding why they cannot dig their well by their own. But after few years, people may understand why the government is saying that they have to charge for private wells. Now the regulation is there, but implementation is difficult. Even there is an Act, regulation, implanting them 100% is very difficult. But this time, we try to mobilize people to make them understand slowly. In some places boreholes without any permission were filled with sand. But nowadays, we try to mobilize them and request them to register for drilling the boreholes. We will visit their site and provide advice to you for drilling the boreholes. But most of the political leaders, they do not care. They need communities’ awareness and votes from the people. We can do this and this because ZAWA cannot do this. Here this is very common to dig wells, provide electricity for the votes. ZAWA is responsible for both water supply and water resource management but we are not good in the water supply even in the water resource management, but now we are concentrating more in water supply and after completion of this side we have to give more attention to the water resource management. At this moment it is hard for us to restrict the private boreholes because they do not have alternative sources from the short water supply.

I read the strategic business plan that regulator will be created in Zanzibar and also water resource management will be our of the ZAWA’s mandate. Is it true?

Mussa: If the ZURA is meant like that, the water should be under different organization but even ZURA they are not suppose to regulate water resources, they are supposed to regulate the water utilities. As for the resources, someone

should manage. Most of the challenges come to the central government. But according to the ZURA, they create something like that, but it is difficult to implement.

So does ZURA exist?

Mussa: Yes, but nothing is happening. They are waiting the president to appoint someone to be a director. But it is still very silent.

When was ZURA established?

Mussa: It was November of December 2013. It was several months ago. We are waiting for them to start their operation. Even the tariff should be approved by them.

Also in the strategic plan, it says that ZAWA would be responsible for sewerage.

Mussa: Yes, but still not yet. Nowadays, it is under the municipality. But the plan is to be under ZAWA. It is still uncertain.

By the way, how do you use the strategic plan? Do you use it for general operation?

Mussa: It was supposed to be used fully. But according to the lack of water resources, financial resources, we cannot implement well according to the strategic business plan. And when we have the strategic plan, it means that everything should be under the business plan. But here we are under the tension of the political views, that is why it is sometimes difficult to manage as it is mentioned in the business plan. Sometime we are moving towards with the political situation.

In my opinion, when I read the strategic business plan, I thought that the report is not written by ZAWA. It is a report written by a third party. It was not an encouraging report for ZAWA.

Mussa: It is not user friendly. It was under the project. It was supposed to be a capacity building. When the consultants create the report, they were supposed to involve the staff like on the job training under JICA. But most of the areas it was under the consultants under AfDB.

There was a SWOT analysis in the report. Did they conducted a workshop involving the ZAWA staff?

Mussa: Yes they tried to do that. But most of the people were not aware and did not have the capacity to participate the SWOT analysis discussion. Because most of them were not business oriented. Most of our staff were technical oriented. It means that the consultant, they filled the SWOT matrix but the involvement of the staff was not enough. The workshop was there but the contribution from the staff was very limited.

I had the same impression. It seemed like the SWOT matric was just written by the consultants. I could imagine the situation.

Mussa: So the strategic business plan is a tool, but for implementation it is difficult for ZAWA. Maybe after five years, ZAWA would have the capacity to implement and perform as written in the strategic plan. The real situation is different from that strategic plan.

Now I am changing the question to the water pricing. When ZAWA was established according to the Water Act. And in the Water Act, it is stipulated that ZAWA should collect the money for water supply. Do you know what were the drivers for shifting to water pricing policies?

Mussa: It is difficult for me to answer because at that time, I was not around. I came here from 2011. Water Act and regulation were already in place. So, I don't know.

At that time you were just the customer of water supply services.

Mussa: I was the one who was blaming to ZAWA. But now I am here and understanding the situation. I am defending my organization and myself.

Ok. I understand that there was PR activities through medias.

Mussa: When the grant aid project were implemented and capacity building project phase 1 was started, there were many campaigns from ZAWA. Most of the people understood about ZAWA through the media campaigns under the sponsorship of JICA. Even myself I watched how the meter is like, staff of ZAWA, they introduce the meter, how to install, how to calculate the bills, how to distribute the bills through TV. Construction of the project was shown in the TV, after completion of the project, we are going to serve water for the Western Region, so please make sure to contribute to ZAWA in order to improve the water supply, it was awareness raising through the media.

Was it effective?

Mussa: Yes it was effective. People understood that this project is on-going and after this project we are going to receive enough water supply in the Western Region. But we also have to pay some amount. The willingness to pay survey was conducted, and myself was also asked and I answered I would pay any if I am getting water supply because now I am paying more every day. So most of the people were aware, especially the people in the town.

After the completion of the project, did the water supply actually improved?

Mussa: Yes, it changed. But the problem is once the project completed, the yield of the springs fall down. Before the project implementation, there was a water coming to Saatini coming from two springs: Bububu and Mtoni. It was used to supply the Stone Town Area. And from that time at least they are supplying a lot of areas, but JICA and ZAWA they said when we complete this project we will increase more supply more to the West and the Urban, but the problem was that in 2010, the springs were affected by maybe climate change of human activities, the production from the springs fell down for 50%. It was a drought. It means that the expected production from the new project plus the existing the production, we could increase the production capacity. But when we finished the project, existing production came down, it means that those gap was filled out by this project. The people did not see so much impact. That was why the people blamed. But that situation was not from the project, but the problem was that there was no one who announced that situation through the media to the people. It was very silent. It was a confidential matter. The drought for the streams. So the people were blaming for the project. But after the new management from 2011, we tried to say something clear that the problem was with the existing source.

What was the reason for making it confidential?

Mussa: We don't know. Maybe it was political influences. At that time it was difficult to say internal things something negative. But now we have the transparency. So the people don't know the actual situation. But now we talk through TV, radio and newspapers. Even the president, he talk to them. And he talked in the cabinet and gave the permission and please go to ZAWA and visit those springs. And the cabinet they visited to see the situations. Why were you not saying this. Mr. President said to us, please go to the media and talk about the situation. That was why the impact of the project was not so obvious to the people. Technical people in ZAWA know the situation that if the yield of the springs did not go down, the production after the project would be much higher. People were very well aware of the project, but after the completion, no one did not talk about the project. It seemed like the project failed, but no one could speak out about the project.

Coming back to the topic on introduction of the water meters, how did ZAWA generated the money for installation of water meters? Was it funded by someone or was it the subsidies from the government?

Mussa: You know at that time, even now, we are mixing our financial resources. We have internal resources from the revenue and also some subsidies for ZAWA. Those meters, some were from the subsidies and some were from revenue. But nowadays, we are collecting some money from the new customers, all the customer who are newly connecting, we are charging for water meter. We are using those fund for purchasing a new meter. The money from the customer for new connection will be not enough but it will be a part of our financial resources.

Are there many requests for the new connections?

Mussa: Yes, you can check them from the billing system.

When ZAWA installed the meters, were there training for ZAWA staff?

Mussa: Yes. Not only training but we also had a small laboratory for testing the meter accuracy was established. There is a standard tank and facility for seeing the accuracy of meters. Before fixing to the house. As for the training, even in the TV we could see how the ZAWA staff was trained by JICA experts. When came to ZAWA I already knew some of the staff as I saw them in the TV.

What kinds of trainings were conducted?

Mussa: One of our staff is a trainer for the new connection and meter readings. He was trained by JICA's project and he is now the trainer for the other staff. How to fix the meter to the house, how to read the meter, how to make the bill, how to distribute the bill.

Was there any training for the bill attendants and meter readers?

Mussa: They are the same person. There was a training for them.

When ZAWA started a billing, was it challenging?

Mussa: Yes it was a challenge because it was completely new for us. In Zanzibar, the bill was only for the electricity. But from that time, citizens started to receive the bills for water and electricity. For that time, we were not only using the bill attendants but we also tried to use the Sheha, local leaders.

For installation of the meters, you explained to the Shehas. Was that the main activities for promoting the meters? Did you have other public relation activities?

Mussa: We conducted community meetings in the areas. There was meeting only for Shehas, Sheha and his/her communities, Sheha and his/her assistance. There were many meetings. It was very well prepared. I was not around at that time but I know that.

There was a testing period for meter readings. Is the result of that study available?

Mussa: I have to check who was responsible for that study. There are many reports in my office. We can also check those reports.

At that time, who was responsible for the meter readings? Is he still with ZAWA?

Mussa: We have some staff who was from that time. Mr. Bilali, Mr. Bhari Khan, we can ask them. One was in our office. Tomorrow we can ask them, they can help us. He is a senior to this authority. He is very knowledgeable.

This will be my last question. Do you have anything to add to my interview?

Mussa: For today, we can stop and maybe we can talk tomorrow. We can talk more and more.

OK. Thank you.

Code: I4

Mr. Hassan Juma Ali

Chief Human Resources

28th May, 2014

Hassan: We developed the organizational structure with NIRAS consultant. The weakness of the structure is we still have three levels. We have director general, directorates, head of departments, we have five departments, before we had only four departments. We used to have technical, commercial, financial and admin and Pemba Branch. But ZAWA is more technical comparing with administrative things, we needed more technical affairs. So we split the technical department into two. We have water development department and technical operation department. So now it is five. We might split the financial and admin in the future because there is no personnel who has the background of both. So it is a common idea but it is not implemented. It will actually take time. Then downward, we have sections. Section are helping the Directorate very closely. Below the technical section we have sewerage section but this is for the future. It is under the municipal council. We have network operation, water production, so these are the sections. We have section head in each section (Refer to the organogram). Whole Pemba is managed by Pemba branch. Director is working as a DG in Pemba. So if you look the organogram, you can only find three levels. Below the section, there are units such as water lab, store, workshops, these are the divisions in the section. There are cashiers and head of cashiers. So there are divisions and units under the sections but they are not integrated into the organizational structures.

Do you have a clear division in the section?

Hassan: It's a matter of research. Because no one was interested in defining those divisions and units under the section. So we did not spare our efforts on that.

In each position, is there any vacancy?

Hassan: No, all are filled in. In these three levels, all the staff are filled in. But under the section, there are some vacancy. For example, there is less pumpers for each pumping station. That is a challenge. Two years back we have recruited many staff for these third levels. The major concern was the recruitment of these three levels, so there were many transfers. Even for myself, there was a problem in human resources, in December 2012, I came to ZAWA. I was working in President's Office, public servant for governance. I was transferred to this position. When I came, I supervised many recruitment for these levels. The last recruitment was finished in just this March 2014. We recruited 53 staff. We had problems with District Water Officer, they were not competent. So we recruited assistant for District Water Officer, so that competent officer would be there. We recruited the people in the customer services, cashiers. I have been working hard for recruiting the staff at these levels. But down to 4th and 5th levels we still have a problem. We still haven't done the need assessment of staff at those levels.

Currently, do you have the figures of number of staff?

Hassan: Yes, if you can join in, you can come to the North District. We went there to mobilize the people there because we are strengthening our district. We had a meeting with the people there and District Commissioner because she was interfering our affairs, she is a politician. She is enforcing her power to our staff. She was reporting to the regional commissioner and then to the President. She wanted to collect the data for water from the District and she was often coming in and out of the office. So we said this is not the scope of your job. So we went to her and make it clear. And things were sorted out. We went to see the performance of our new staff because they were recruited in March and this is May. So today, we are going to the Central District with the Planning and Financial Director if he could manage his time.

Can I see the data for number of staff?

Hassan: Yes, we created a inventory of our staff. You can even find the new staff in that inventory.

Can I ask you about the trainings for the staff? I suppose you have regular trainings and ad-hoc trainings according to the demands. What kind of trainings do you have?

Hassan: If there is an area where we are not doing good and we need to make efforts, that is training. The problem of ZAWA from my experience, the problem with the governmental departments is the training programme. We don't have enough budget for regular training. Like this time, I only have very minor budget for training. We apply the budget for the training but it is just like a formality, but practically, implementation is not there. So what happens, staff can apply for personal trainings by using his own money, can go for a loan from the bank and get the permission from the organization. You cannot stop someone who is ready to finance for their own training but at the same time that person is interfering the human development programme, because the area he or she wants to study might not match with the organization. So for instance, some one could get the degree on where he does not have to get the degree and as a result, that person will not get the promotion. And that person will be frustrated and run away or becomes a spoiler. There are some people who go for trainings but that is for the areas they desire and that is not the area which organization desires.

Hassan: When we comes to the lower level, we conduct a practical trainings. For example, the plumbers, there are staff who has the skills but informally. They see and practice new things with the experienced staff. So in such training, ZAWA is doing very well. Recently we developed our water resource centre. This year we took almost 40 staff to the centre, to train them to water development for learning mechanics, water labs, electricity etc. It was created this year in January in order to improve the skills of the staff. Some of the staff are very skillful but the salary is not so high, because they do not have the certificates, so they need to go get the certificates so that we can increase their salary and at the same time, after retirement, they could be hired by somewhere else because they are knowledgeable. So for the lower levels we are doing good. Like 6-7 there are staff who is studying in the other colleges, but other thing we are doing good is ad-hoc trainings. Here we are doing the best. As you witnessed by yourself, we have projects going on, JICA is helping us providing trainings, every year, there are exposure visit to somewhere. We have some staff going to China, India etc. So more and more people are trained every year.

There are some external trainings like getting degrees, and ad-hoc trainings. But is there any internal trainings?

Hassan: Yes we have, but not planned. Still the internal training is organized by the project and not yet regularized. But we as ZAWA, it is very rare that HR Section is organizing the internal trainings. As you may know, you can come with a good creativity, but if it involves money, it becomes a problem for us.

So regularizing the ad-hoc training will be a next challenge.

Hassan: In my opinion, our development partners are doing very well on providing trainings in both indoors and outdoors. These might be enough for us.

Are the staff of ZAWA interested in joining the trainings, not only external but also internal trainings.

Hassan: Yes, they are very eager. The most conflict between the manager and the staff is when you deny the training opportunity. You will receive many complaints. These are the main crash. Our staff is very keen on learning.

Because I thought that training would be a incentives or motivations for the staff.

Hassan: Yes, it is a big motivation for the staff. Because they need it. When we established our water development centre, we thought that the staff might not be interested and join, if you can imagine some of them are not literate even for Swahiri, there some of the staff in that level. But they still want to learn, they say I know how to connect the pipes and I can do it the best. I must study. If you come to the class and see, it is very interesting. It is a continuous process.

I think certificate of degree is not required for every level. For instance even the illiterate staff, they need the practical skill.

Hassan: The problem in Tanzania, when it comes to salary or promotion, we look at their certificate and reflect it to the salary. Maybe in the development nations, certificate does not matter. You will be paid according to the duties you are

holding. It doesn't matter if you are a professor, master, whatever. If your task is more difficult than the others, that person may get a better salary. But here it is all about the certificate and degree, which you are holding. That is also one of the reasons why people are very motivated to learn. There are some staff, one who is called Bangi, he retired but them we extended his employment for another two years, he did not have any certificate or degree. But he was working very well. You cannot give him a low salary because he is an exceptional person. In that case, his salary was increased for the 2-year contract period. But his salary was very low when he was working as a regular staff of us because he did not have any certificate.

Is there any regulation for ZAWA to follow in terms of the salary?

Hassan: Yes. There is. There is a salary scale. In remuneration policy it is written. The person who has this certificate, 1000, this certificate, 2000. Like this. So it depends upon the certificate.

Some of the water utilities in the other countries can define their salary of staff because they have the autonomous status. In case of ZAWA, is it controlled by the government?

Hassan: No, we can control our salary. But not in terms of general implementation. If the government salary, it is written. We in ZAWA, comparing to the government, it is slightly higher. We are adding on to the governmental scale because we are business entity. We have to motivate the staff to make sure that they are motivated for working. But not in the general sense that we are excluding the certificate from the salary scale. Because it matters to the education, we need to see the competency.

Generally it is said that the water utilities have to be customer oriented and to work more as a commercial entity. In that sense, how do you see the performance of ZAWA?

Hassan: Most of the staff has the commercial or technical background. We have 702 staff right now.

If you can assess, in the administration, we are not in the hurry, we are more concerned in technical and revenue collection. For administration, we have very few staff. We need more competent staff. We all go to Nkata Nkata every Thursday. The main concern is that is revenue collection. Because by raising the revenue, we can increase the services to more people. There is no shortcut unless we don't collect the bill. We organize ourselves here and around 9:30 we take off and visit the site.

Do you have anything to add or suggest to my interview?

Hassan: You can always come to me and talk with me. I don't hide because I am not a politician. Sometimes it is better to attend our programme, so that you can go to the field and see by yourself. It is better you exposure yourself and see what is going on.

Thank you.

Code: I5

Mr. Abdul Bari Kai Haji

Mr. Bilal Khalid Abass

Assistant Technician, Credit Control Section

28th May, 2014

I would like to know about the situation of installing the meters in Makadara. Was it between 2010 and 2011?

Bilal: In Makadara, we have 878 meters installed up to now.

When you first install the meters in Makadara, I think there was 300 meters purchased by JICA and the others were purchased by ZAWA?

Bilal: The meters first installed was 800 in Makadara. And ZAWA bought meters as well. Then JICA also bought meters for Bububu and Tabeta. ZAWA purchased the meters for Korekue and Chuaka and Marumbe and Kinichi.

Were the one who installed the meters in Makadara?

Bilal: Yes.

Do you remember the month you start installing the meters in Makadara?

Bilal: Wait for a moment. The first meter was this type. It was purchased by JICA. We were first installing this type, but people were steeling this meters because of this brass. So it is better to use the plastic meters.

Are these two types are the meters installed in Makadara?

Bilal: There are other kinds as well. This type is for Bububu.

This meter is coming from Turkey?

Bilal: Maybe it is coming from China. Inside, it says Fuji. Fuji is maybe from China.

It that the record for meter installation?

Bari Kai: Yes, this is a form we are using for the meter installation. There is place for writing the name of the house owner, account number, meter number, plot numbers, etc.

Which file is for Makadara?

Bari Kai: They are the record for Makadara.

OK. You have the name of the staff who installed the meters. Are there date for installation?

Bari Kai: Yes, it is written on the another page. This is the first customer who installed the domestic meter in Zanzibar.

So it started in June 2010. After you install the meters, ZAWA started the meter readings and bill processing based on the water consumption. Do you remember the month which ZAWA started the billing with the volumetric tariff? After installing the meters, did you immediately started the billing based on volumetric tariff?

Bari Kai: We have a meter reading record. That meter reading record will be filled in by billing attendants and submitted to the database section. Have you seen that form?

No, is it kept in your office?

Bari Kai: Let me check. Maybe Mr. Makame in the database section knows.

Bilal: Meter installation was started by Mr. Inoue, he was my teacher. He also designed the meter yard.

So the first meter installation was like the on the job training. After installation of the meters, when did ZAWA start the billings? Was it after installing all the meters in Makadara or after installing 300 meters?

Bilal: We started to bill the customers after maybe after one month. Let me show you the database. This is SBM1.

Bari Kai: These are the form for meter readings.

Thank you. This is starting from October 2011.

Bari Kai: When we started the meter readings. Mr. Kinyangi and I were responsible but we left that section and we succeeded the file of the beginning of the meter readings. So I am not sure where those files are. But this is the form for the meter reading.

Bilal: This person, Mr. Suleiman, he is the first customer. You can see the changes from flat rate to volumetric tariff. Now here is flat rate and from here it is volumetric tariff.

What is this water payment?

Bilal: It means that this customer came to pay the bill.

Ok. So they are paying less amount comparing to the flat rate. Is it possible to collect this data for every customer in Makadara?

Bilal: Yes, you can.

Bari Kai: If install the meters, at the end of the month, we read the meters and process and send the bills.

What is this correction of water charges?

Bari Kai: This means that the customer came to claim that the bill is wrong.

Ok, now it is very clear. Thank you.

Code: I6

Mr. Hakim Ali Foum

Chief Monitoring and Evaluation (Previously working as public relation officer)

30th May, 2014

I would like to ask about the public relation activities at the time ZAWA introduced the volumetric tariff based on the meter readings. So, I think before introducing the meter, people were charged with flat rate and then ZAWA installed the meters in Makadara, and then ZAWA started to charge with new tariff. So, what kind of PR activities did ZAWA conduct before introducing the new tariff.

Hakim: First of all, from 2010 to 2012, there were three PR officers. One was dealing specifically for administrative works, the other one was technical and the third was for commercial. The commercial public relation officer was the one who was dealing with every information concerning payments. First, we started educating people on how to use water responsively. Then we also conducted public meeting with JICA, I remember commercial director Mr. Oma, Mr. Aoki and the Sheha in Makadara. The purpose of the meeting was to educate Shehas, so that they can shift the education from us to the people on how to use water, on how to conserve water, and what are the advantages of, its not payment, its assistance to ZAWA. Secondly, we also conducted workshop with Aoki, with ZAWA and all the Shehias in the other regions. The purpose of that was to try to tell them that we have established this volumetric tariff we are going out from the flat rate. And we started with Makadara and we will proceed to other Shehias. The responses were very good, because one of the things we try to connect was introduction of water committees. This volumetric tariff will go on hand in hand with introduction of kiosk project. The people who will be responsible for the kiosk at are the water committees. They responded very well.

So that water committee programme and change from flat rate to volumetric tariff, did they go simultaneously or were they the different programme?

Hakim: It was supposed to go hand in hand. But so far all of the committee were registered they are here but the implementation, they haven't started yet.

So you had such kind of public meetings and workshop.

Hakim: We had two workshops. One at, it was not organized here because it was covering the whole regions, and another was conducted here, targeted the Urban District only.

That was for Shehas.

Hakim: Yes.

As for the Shehas, you had a meetings, but how did you informed to the customers.

Hakim: When we first talked to the customers, we first conducted a survey. We were together with Aoki and Amina. We wanted to know what were they perceiving from ZAWA. Which way do they prefer payment. It is volumetric or flat rate. And apparently, all of them chose volumetric. They said that, on one side there are people who pay 4000 without getting any water, on the other side they said, we are using more than what we pay. So we need a meter because A: we can regulate ourselves, B: we can pay according to what we use, because we hardly get water maybe once a day, week, yet others get water 24 hours a day. So if there is a meter, I will pay according to what I use, and I will also control others for getting water, if you have a meter, you will control yourself, how to use water. Because at the end of the day, you have to pay for it.

I see. So, they though that they could save water to pay less.

Hakim: At the same time they thought that they could save money.

So most of the people preferred to install the meters.

Hakim: Yes.

And you said you conducted the customer survey.

Hakim: We went to Mandege, Tanga Shehias. Those are the Shehias not far from Makadara. We also went to Makadara to collect the data concerning customer satisfaction, which way do they prefer.

Was there any other public relation activity?

Hakim: You know, public relation activities, apart from education people and how to save water, use water properly, it was also how to maintain the water meters. Because at the beginning, there was a lot of reports that meters were destroyed, sold, stolen, so another task, okay we took people to police and the cases are still there, but we did not want to make the customers as enemies, so we had to introduce another session which was specifically to educate the people on how to maintain the water meters.

I understand that ZAWA introduced the water meters around end of 2010.

Hakim: Actually, before 2010. Because when I was here before 2009, that was the time they start install meters.

Was it for domestic or commercial?

Hakim: Yes, we are now talking about domestic.

Was it in Makadara or other areas?

Hakim: They started in Makadara and they went to Kidichi, Mombasa, there were some areas I have forgotten. I will mention when I got the whole data.

I read in the report that you had some TV programme was broadcasted.

Hakim: The programme was called, in English, “Its time for you to know that the ZAWA is”. The progamme was about, you know we were trying to educate people that this is no longer water department. This is a semi-autonomous organization. We do not get cash directly from the government, you know, it is a small amount, so we have to create our own cash. So the programme was about informing people that ZAWA is about to start charging for water. The amount that they are going to get, or we are going to get, will help us to maintain the water resources, infrastructures, human resources and so on. So even the introduction of water committees, the water kiosks and water meters were also part of the programme but very small. You know we wanted to tell people that these things have been devolved. We are no longer relying on the government, this is not a department. It is a complete organization.

Ok. So, that was the main purpose of the programme and one of the contents was about installation of meters and introduction of the volumetric tariff. How was the response from the people?

Hakim: You know, first of all, the water is something very political, so if you tell someone that we are going to charge you, of course the responses will not be good. But in my view, this was just the beginning of ZAWA, we did not expect good result. That’s why after the this programme, we did the survey and saw how people had responded according to what we have told them.

So in the beginning, the politicians and other people, they complained about charging for water. But gradually,..

Hakim: At the beginning, they did not understand, they were used with the free water. So in the beginning it was difficult but when the days go on, they have started to understand and frankly speaking, now they are the one who use this water payment as a campaign rally, if you understand what I mean. In the beginning, it was like, if you choose me, I will give you water for free, something like that was happening, but now, if you choose me, I will make sure that you will get good quality of water with a reasonable price. That means, they have started to understand that water have to be paid.

In that sense, ZAWA ‘s services to the customers become better?

Hakim: Compared to the previous years, sure it is improving. According to the survey we have conducted, the services have improved. Or rather we can say customers’ satisfaction have improved. For example in areas which for example, Michinzani, it is not far from here. They had very big problem with water. But now they do get water, and in fact, they are the one who are asking for volumetric tariff, in the beginning they did not want to get anything concerning ZAWA. Now, they are not only assisting us but also they are also asking for volumetric payment, so they can pay according to what they use, because they think they using too much water and they can pay less money.

Why are they getting water now?

Hakim: There was a project called nine borehole project. We are planning to construct nine boreholes to Bunbwinin and Saatini. So far we have three which are designed to provide water specifically from Saatini to all the way to the stonetown.

That project was conducted by ZAWA's own financial resources?

Hakim: Yes.

Do you remember when that project was conducted?

Hakim: That was the time when I was at school from 2010 to 2011.

I think I don't have any further questions. So actually those people in Makadara, they were willing to install the meters because of the reasons you explained to me. And concerning the transition from the flat rate to volumetric tariff, are there anything you wan to mention to me?

Hakim: Just suggestion. We have installed meters in other areas. I still insist to install the areas that we are familiar with. For example, we have Michinzani, Kilimani, those are flats, apartments. We all know how many people are there. So if we install meters, it would be easy for us to control water usage and also to get exact amount of what we want. But if we install meters where it has different sources apart from ZAWA's it is wastage of the resources. Bur for Michinzani, they have only ZAWA's source. So whether they like it or not, they use the water from ZAWA and the meters will be effective to installing to the meters in the areas which have different sources like, they have local resources like wells, rainwater harvesting, they have different sources. So they want to rely on your meters. So the meters will just there. But if we put the meters where there is only one source, it will not only be profitable for us but even for water management itself.

Is that about the Shehias in the Urban District?

Hakim: There are different Shehias, for example Michinzani, there are more than three Shehias.

Is it the name of the District?

Hakim: No, it is a name of blocks. Do you know quality supermarket?

No, I don't. But I know where the apartments in the Urban District are.

Hakim: Yes, that is where Michinzani is. So each block has each Shehia. There are ten. So there could be under ten different Shehias.

Can I ask another question? You just mentioned about different water sources, like local wells and private wells. Do they usually pay for those water sources?

Hakim: They supposed to pay. If it is domestic use they are supposed to pay 50000 per year. But frankly speaking, it is still a challenge.

I mean locally, for example, the customer has a borehole and may be someone is pumping it up the water to the tank. So there are some cost involved in the system. So in such local situation, do people pay for that water supply within the community?

Hakim: It depends. Some of the wells are owned by the politicians. So they are paying for electricity and everything. Others are owned by the community. So they make contribution and pay. Others are owned by individuals. So I pay for this. I provide water for you. You still have to pay me. Such kind of system, you can find it in the Stone Town. There is a, I call it private water supply and they are called water cable. Our water is distributed underground, but their water is provided from in above your head. So they have their own source, they provide water, and at the end of the month, you have to pay. So the payment depends on, whether you are domestic or commercial, or relationship between the owner and the user. For instance, if the owner is my uncle, relatives, he gives me a discount. But if he doesn't know me, then he charges me normal. The normal price for domestic is around 20,000. For commercial, it depends on how big your hotel is.

So that private venders, are those common in Stone Town only? Do they exist in Makadara?

Hakim: No, they only exist where the water from ZAWA is not coming. In Makadara, they don't need a system like that. Because they own water.

Ok. Thank you very much.

Date: 27/5/2014
Time: 9:28 – 10:59
Investigator: Takeshi Saheki, Mkasi Haji Zubeir, Saada Khalad Muhidin

House connection

Location	Who	How (directly from tap? hose? etc.)	What purpose (storage? Specific usage?)
2 (9:56)	House wife	Directly from the tap inside the house	Laundry and storing in the basin
8	House wives (3)	Storing water in the basin	Laundry

Public source

Location	Type	Characteristic (number of people/pressure)	Who (gender/age)	How	What purpose
1	Public stand pipe	High water pressure, no usage, leakage No pricing	None	None	None

Carriage of water

Who (gender/age)	How	What purpose
8: neighbour (disconnected due to non-payment)	Carrying water with 2 containers	Borrowing water from the neighbours because their water was disconnected. The disconnected household was not charged from the neighbour.

Other notes

Date: 27/5/2014
Time: 9:28 – 10:59
Investigator: Takeshi Saheki, Mkasi Haji Zubeir, Saada Khalad Muhidin

House connection

Location	Who	How (directly from tap? hose? etc.)	What purpose (storage? Specific usage?)
7	Small noodle factory (but domestic customer) with 5 employees Address: A1-009 Meter no. 35145298	From the tap	Making Chinese noodles

Public source

Location	Type	Characteristic (number of people/pressure)	Who (gender/age)	How	What purpose
3 (10:12)	Public well	Elevated tank and borehole No water stored (electric pump not working)	None	None	Domestic
4	Public standpipe	4 taps connected to borehole or ZAWA water. Locked by the house nearby. High water pressure.	No usage at the time visited	None	Domestic
5 (10:22)	Public well	Borehole? Illegal connection? Tap was connected with hose and shared with neighbours.	Housewives of different houses	Storing water with the hose	Domestic uses other than drinking and cooking
6	Kiosk	Small grocery shop which also has a function of water kiosk but no one buying water	Two shopkeepers	Storing water in the basin	Washing vegetables(not selling water)

Carriage of water

Who (gender/age)	How	What purpose

Other notes

No. _____

Date: / / 2014

Account No. _____

Meter No. _____

Household Survey for Analysing the Effect of Volumetric Water Tariff
Format for Metered Customer

Introduction:

The purpose of this survey is to collect data from the household that have been installed the water meter. The data will be used to analyse the water consumption before and after the introduction of volumetric tariff.

The questionnaire contains the questions related to your water usage and household information. It will take maximum 10 minutes.

The data will be used confidentially only for this research purpose.

Respondent's Name: _____

Sex: Male / Female

(Age): _____

Address: _____

Name of the householder: _____

Householder's occupation: _____

Household members:

Number of males _____

Number of females _____

Number of children (up to 18) _____

Part 1: First, let me ask you about your present situation of water usage.

Q1. Do you use house connection supplied by ZAWA? **Yes** / **No**

Q2. What other water sources do you use? Tick **every** water sources you use.

Q3. Number the ticked water sources in the order you use the most (up to three).

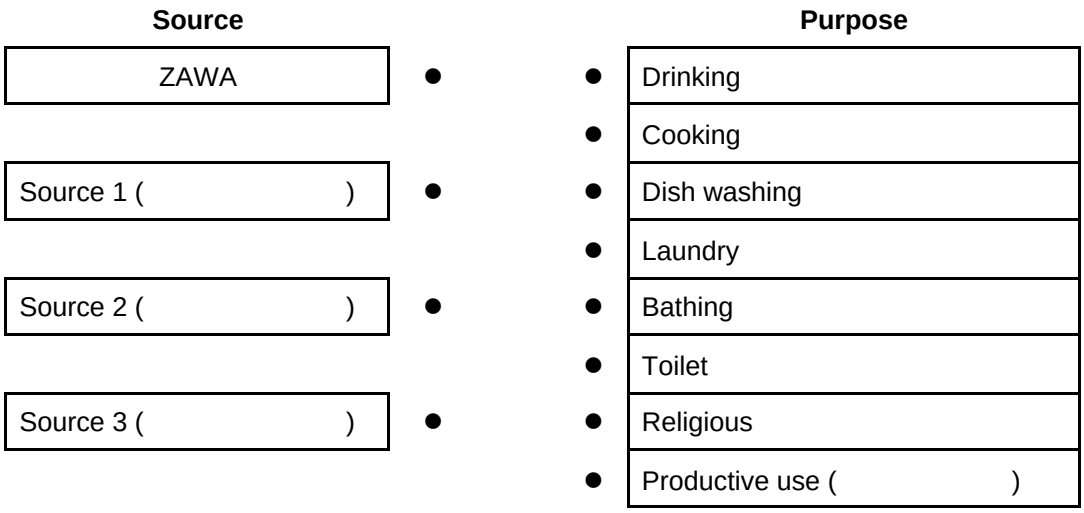
Source	Use (Q2)	Order (Q3)
1) Borehole		
2) Public standpipe		
3) Water from the neighbours		
4) Water from the private vendors		
5) Water from the kiosks		
6) Rainwater		
99) Others ( )		

Q4. What do you use water for? Connect each source to every corresponding purpose you are using for.

(*If you use the water from the neighbours, do not include that to "ZAWA" source.*)

(*Even if you mix the water in the storage, please draw the lines separately.*)

(*Productive use: commercial, agricultural, gardening, etc.*)



Part 2: Let me ask you about the house connection from ZAWA.

Q5. How many hours can you get water from ZAWA in a day? _____ **hours**

Q6. What do you think about the water pressure? Choose one number from below.

Very low	Low	Fair	High	Very high
1	2	3	4	5

Q7. Do you use booster pump to suck the water from ZAWA? **Yes** / **No**

Q8. If "Yes", when did you install the booster pump? Choose one number from below.

Before 2010	2011	2012	2013	2014
1	2	3	4	5

Q9. Do you share the water from ZAWA with your neighbours? **Yes** / **No**

Q10. If "Yes", how many households are using the water from your house? _____ **HHs**

Q12. When the volumetric tariff was first introduced to your house, did you know that the tariff is changing from that month? **Yes** / **No**

Q13. Was there any change in water usage after the introduction of volumetric tariff? **Yes** / **No**

Part 3: Let me ask you about the alternative sources.

Q14. Do you pay for using the **Source 1:** _____? **Yes** / **No**

Q15. If yes, how much do you pay for a day / week / month? _____ **Tsh**

Q16. Do you pay for using **Source 2:** _____? **Yes** / **No**

Q17. If yes, how much do you pay for a day / week / month? _____ **Tsh**

Q18. Do you pay for using **Source 3:** _____? **Yes** / **No**

Q19. If yes, how much do you pay for a day / week / month? _____ **Tsh**

Part 4: Let me ask you about your private information.

Q20. How much did your household pay for your last electricity bill? **Tsh** _____

Q21. How much did you pay for your last mobile phone bill? **Tsh** _____

Q22. What is the approximate monthly household income of your household? Please circle the numbers below.

Less|----------|----------|----------|----------|----------|----------|----------|----------|----------|More

20,000 40,000 60,000 80,000 100,000 120,000 140,000 160,000 180,000 200,000 Tsh

Q23. What do you think about the quality of ZAWA's service? Choose one number from below.

Very poor	Poor	Fair	Good	Very good
1	2	3	4	5

Q24. Do you have any request or suggestion on the service of ZAWA?

Thank you so much for your cooperation. The questionnaire will be used confidentially.

No. _____

Tarehe: ____ / ____ / 2014

Namba ya akaunti: _____

Namba ya mita: _____

Utafiti kwa wateja wa majumbani wanaolipia huduma ya maji
Imeandaliwa kwa wateja wenye mita

Utangulizi.

Lengo la utafiti huu ni kukusanya taarifa za wateja wa maji wa majumbani ambao wameshafungiwa mita.Taarifa hizi zitatumika kutambua matumizi halisi kabla na baada ya ufungaji wa mita.

Dodoso hili Lina maswali kumi yatakayohusiana na matumizi yako halisi ya huduma ya maji. Inategemewa kuchukua jumla ya dakika kumi

Taarifa hizi ni siri, na zitatumika kwa ajili ya utafiti pekee.

Jina la mhusika: _____

Jinsia: mme / mke

umri: _____

Anuani: _____

Jina la mmiliki wa nyumba: _____

Kazi ya mmiliki wa nyumba: _____

Idadi ya waliomo ndani ya nyumba:

Idadi ya wanaume _____

Idadi ya wanawake _____

Idadi ya watoto (hadi miaka 18) _____

Sehemu ya 1: kuhusu matumizi yako halisi ya maji.

Q1. Umeunganishwa na huduma za ZAWA? **ndio** / **hapana**

Q2. Kuna aina nyengine ya chanzo cha maji unachotumia? Weka alama kwa aina nyengine ya chanzo unachotumia.

Q3. Weka alama na namba katika chanzo cha maji unachotumia mara nyingi zaidi (hadi vyanzo 3).

chanzo	matumizi (swali2)	mpangilio (swali3)
1) Kisima		
2) Mifereji ya jamii		
3) Maji kutoka kwa jirani		
4) Maji kutoka kwa wasambazaji		
5) Maji kutoka kiosk		
6) Maji ya mvua		
99)Nyengine ( )		

Q4. Unatumia maji kwa kazi gani kuu? Linganisha chanzo unachotumia kulingana na matumizi yako. (*matumizi ya uzalishaji: biashara (viosk vya chipsi, juisi), kilimo, bustani, nk.*)

Chanzo		**Matumizi**
ZAWA	●	● Kunywa
		● Kupikia
Chanzo 1 ( )	●	● Kuoshea vyombo
		● Kufulia
Chanzo 2 ( )	●	● Kuogea
		● Choo
Chanzo 3 ( )	●	● Matumizi ya kidini
		● Matumizi ya uzalishaji( )

Sehemu ya 2: kuhusu nyumba iliyounganishwa na ZAWA.

Q5. Kwa siku unapata maji kwa masaa mangapi kutoka ZAWA? _____ **masaa**

Q6. Una maoni gani kuhusu nguvu ya maji? Chagua namba moja hapo chini.

Ndogo sana	ndogo	afadhali	kubwa	Kubwa sana
1	2	3	4	5

Q7. Je Unatumia mashine kwa ajili ya kuvuta maji yanayotoka ZAWA? **ndio** / **hapana**

Q8. ikiwa“ndio”, lini umeanza kutumia mashine hio? Chagua namba moja hapo chini.

kabla 2010	2011	2012	2013	2014
1	2	3	4	5

Q9. Unatumia huduma ya maji kutoka ZAWA pamoja na majirani? **ndio** / **hapana**

Q10. Ikiwa “ndio”, ni nyumba ngapi zinachukua maji kutoka nyumbani kwako? _____ **HHs**

Q12. Je ulikua na taarifa juu ya mabadiliko ya bei ya malipo ya maji? **ndio** / **hapana**

Q13. Je kuna mabadiliko yoyote kwa matumizi yako ya maji baada ya kufungiwa mita na kuanza kwa bei mpya? **ndio** / **hapana**

sehemu ya 3: kuhusu chanzo chako cha maji

Q15. Je unalipia maji kutoka katika **Chanzo 1:** _____? **ndio** / **hapana**

Q16. Ikiwa “ndio”, kiasi gani unalipa kwa **siku / wiki / mwezi?** _____ **Tsh**

Q17. Je unalipia maji kutoka katika **Chanzo 2:** _____? **ndio** / **hapana**

Q18. Ikiwa “ndio”, kiasi gani unalipa kwa **siku / wiki / mwezi?** _____ **Tsh**

Q19. Je unalipia maji kutoka katika **Chanzo 3:** _____? **ndio** / **hapana**

Q20. Ikiwa “ndio”, kiasi gani unalipa kwa **siku / wiki / mwezi?** _____ **Tsh**

Sehemu ya 4: kuhusu habari zako binafsi.

Q21. Mara ya mwisho kulipia huduma ya umeme ilikua kiasi gani? _____ **Tsh**

Q22. Mara ya mwisho umetumia kiasi gani kuweka vocha katika simu yako? _____ **Tsh**

Q23. Kipato chako halisi cha mwezi ni kiasi gani? Tafadhali zungushia jibu sahihi.

chini|----------|----------|----------|----------|----------|----------|----------|----------|----------|zaidi

20,000 40,000 60,000 80,000 100,000 120,000 140,000 160,000 180,000 200,000 **Tsh**

Q24. Unazionaje huduma za ZAWA? Chagua namba moja chini.

Mbaya sana	Mbaya	Afadhali	Nzuri	Nzuri sana
1	2	3	4	5

Q25. Je una maoni yoyote kwa mamlaka ya maji ZAWA?

Ahsante kwa ushirikiano wako. Taarifa za dodoso hili ni za siri.

Statistics

		Consumption of month n=1	Average consumption of month n=7-18	Difference between month n=1 and 7-18	Average consumption of Oct 2013 to Apr 2014	Usage of alternative source
N	Valid	134	134	134	134	134
	Missing	0	0	0	0	0
Mean		11.910	13.313	-1.425	13.507	
Median		10.500	13.000	-2.000	13.100	
Std. Deviation		7.8735	5.7208	7.8399	6.4515	
Minimum		1.0	1.0	-24.0	1.6	
Maximum		49.0	30.0	31.0	34.9	

Statistics

		Sharing water with neighbours	Service hours	Customer's rating for water pressure	Number of household members	Number of children in the house
N	Valid	134	133	123	134	134
	Missing	0	1	11	0	0
Mean			7.27		5.77	2.18
Median			8.00		6.00	2.00
Std. Deviation			2.853		2.675	1.859
Minimum			1		1	0
Maximum			12		15	10

Statistics

		Monthly payment for electricity bill	Monthly payment for mobile phone	Monthly household income	Satisfaction level for ZAWA's services
N	Valid	134	134	66	130
	Missing	0	0	68	4
Mean		Tsh11,746.27	Tsh1,225.37	Tsh108,484.85	
Median		Tsh5,000.00	Tsh500.00	Tsh100,000.00	
Std. Deviation		Tsh14,092.971	Tsh4,494.268	Tsh85,002.125	
Minimum		Tsh0	Tsh0	Tsh20,000	
Maximum		Tsh70,000	Tsh50,000	Tsh400,000	

Frequency Table

Consumption of month n=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.0	2	1.5	1.5	1.5
	2.0	3	2.2	2.2	3.7
	3.0	5	3.7	3.7	7.5
	4.0	8	6.0	6.0	13.4
	5.0	5	3.7	3.7	17.2
	6.0	7	5.2	5.2	22.4
	7.0	9	6.7	6.7	29.1
	8.0	15	11.2	11.2	40.3
	9.0	7	5.2	5.2	45.5
	10.0	6	4.5	4.5	50.0
	11.0	5	3.7	3.7	53.7
	12.0	10	7.5	7.5	61.2
	13.0	12	9.0	9.0	70.1
	14.0	9	6.7	6.7	76.9
	15.0	9	6.7	6.7	83.6
	16.0	1	.7	.7	84.3
	17.0	1	.7	.7	85.1
	18.0	1	.7	.7	85.8
	19.0	1	.7	.7	86.6
	20.0	1	.7	.7	87.3
	21.0	2	1.5	1.5	88.8
	22.0	2	1.5	1.5	90.3
	24.0	1	.7	.7	91.0
	25.0	1	.7	.7	91.8
	26.0	1	.7	.7	92.5
	27.0	1	.7	.7	93.3
	28.0	1	.7	.7	94.0
	30.0	2	1.5	1.5	95.5
	31.0	1	.7	.7	96.3
	32.0	3	2.2	2.2	98.5
	34.0	1	.7	.7	99.3
	49.0	1	.7	.7	100.0
	Total	134	100.0	100.0	

Average consumption of month n=7-18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.0	1	.7	.7	.7
	2.0	1	.7	.7	1.5
	3.0	2	1.5	1.5	3.0
	4.0	1	.7	.7	3.7
	5.0	3	2.2	2.2	6.0
	6.0	6	4.5	4.5	10.4
	7.0	7	5.2	5.2	15.7
	8.0	4	3.0	3.0	18.7
	9.0	12	9.0	9.0	27.6
	10.0	5	3.7	3.7	31.3
	11.0	9	6.7	6.7	38.1
	12.0	15	11.2	11.2	49.3
	13.0	12	9.0	9.0	58.2
	14.0	9	6.7	6.7	64.9
	15.0	7	5.2	5.2	70.1
	16.0	5	3.7	3.7	73.9
	17.0	3	2.2	2.2	76.1
	18.0	5	3.7	3.7	79.9
	19.0	6	4.5	4.5	84.3
	20.0	6	4.5	4.5	88.8
	21.0	4	3.0	3.0	91.8
	22.0	2	1.5	1.5	93.3
	23.0	2	1.5	1.5	94.8
	24.0	1	.7	.7	95.5
	25.0	1	.7	.7	96.3
	26.0	1	.7	.7	97.0
	27.0	3	2.2	2.2	99.3
	30.0	1	.7	.7	100.0
	Total	134	100.0	100.0	

Difference between month n=1 and 7-18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-24.0	1	.7	.7	.7
	-15.0	2	1.5	1.5	2.2
	-14.0	2	1.5	1.5	3.7
	-13.0	1	.7	.7	4.5
	-12.0	4	3.0	3.0	7.5
	-11.0	1	.7	.7	8.2
	-10.0	4	3.0	3.0	11.2
	-9.0	4	3.0	3.0	14.2
	-8.0	8	6.0	6.0	20.1
	-7.0	3	2.2	2.2	22.4
	-6.0	6	4.5	4.5	26.9
	-5.0	8	6.0	6.0	32.8
	-4.0	8	6.0	6.0	38.8
	-3.0	11	8.2	8.2	47.0
	-2.0	10	7.5	7.5	54.5
	-1.0	8	6.0	6.0	60.4
	.0	9	6.7	6.7	67.2
	1.0	11	8.2	8.2	75.4
	2.0	3	2.2	2.2	77.6
	3.0	5	3.7	3.7	81.3
	4.0	3	2.2	2.2	83.6
	5.0	5	3.7	3.7	87.3
	6.0	2	1.5	1.5	88.8
	8.0	3	2.2	2.2	91.0
	9.0	1	.7	.7	91.8
	10.0	2	1.5	1.5	93.3
	11.0	2	1.5	1.5	94.8
	12.0	2	1.5	1.5	96.3
	16.0	2	1.5	1.5	97.8
	20.0	1	.7	.7	98.5
	30.0	1	.7	.7	99.3
	31.0	1	.7	.7	100.0
	Total	134	100.0	100.0	

Average consumption of Oct 2013 to Apr 2014

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.6	1	.7	.7	.7
	2.4	1	.7	.7	1.5
	2.5	1	.7	.7	2.2
	3.1	1	.7	.7	3.0
	3.9	1	.7	.7	3.7
	4.7	2	1.5	1.5	5.2
	4.9	1	.7	.7	6.0
	5.1	2	1.5	1.5	7.5
	5.6	3	2.2	2.2	9.7
	5.9	1	.7	.7	10.4
	6.0	2	1.5	1.5	11.9
	6.1	3	2.2	2.2	14.2
	6.3	1	.7	.7	14.9
	6.4	1	.7	.7	15.7
	6.7	1	.7	.7	16.4
	7.0	1	.7	.7	17.2
	7.1	1	.7	.7	17.9
	7.7	1	.7	.7	18.7
	8.0	1	.7	.7	19.4
	8.1	1	.7	.7	20.1
	8.4	1	.7	.7	20.9
	8.6	1	.7	.7	21.6
	8.7	1	.7	.7	22.4
	9.0	3	2.2	2.2	24.6
	9.1	1	.7	.7	25.4
	9.2	1	.7	.7	26.1
	9.3	2	1.5	1.5	27.6
	9.4	1	.7	.7	28.4
	9.6	3	2.2	2.2	30.6
	10.2	1	.7	.7	31.3
	10.3	1	.7	.7	32.1
	10.4	1	.7	.7	32.8
	10.6	1	.7	.7	33.6
	10.7	2	1.5	1.5	35.1
	10.9	3	2.2	2.2	37.3
	11.0	2	1.5	1.5	38.8
	11.3	3	2.2	2.2	41.0
	11.4	2	1.5	1.5	42.5
	11.7	2	1.5	1.5	44.0
	11.9	2	1.5	1.5	45.5
	12.3	2	1.5	1.5	47.0
	12.6	2	1.5	1.5	48.5
	13.0	1	.7	.7	49.3
	13.1	2	1.5	1.5	50.7
	13.3	2	1.5	1.5	52.2
	13.4	3	2.2	2.2	54.5
	13.6	1	.7	.7	55.2
	13.7	1	.7	.7	56.0
	13.9	1	.7	.7	56.7
	14.0	3	2.2	2.2	59.0
	14.3	2	1.5	1.5	60.4
	14.4	1	.7	.7	61.2
	14.6	1	.7	.7	61.9

	14.7	4	3.0	3.0	64.9
	15.1	1	.7	.7	65.7
	15.4	2	1.5	1.5	67.2
	15.6	1	.7	.7	67.9
	15.7	2	1.5	1.5	69.4
	16.3	1	.7	.7	70.1
	16.7	3	2.2	2.2	72.4
	17.0	4	3.0	3.0	75.4
	17.2	1	.7	.7	76.1
	17.3	1	.7	.7	76.9
	17.6	1	.7	.7	77.6
	17.7	1	.7	.7	78.4
	18.3	1	.7	.7	79.1
	18.4	1	.7	.7	79.9
	19.0	3	2.2	2.2	82.1
	19.3	1	.7	.7	82.8
	19.4	3	2.2	2.2	85.1
	19.6	1	.7	.7	85.8
	19.7	1	.7	.7	86.6
	20.1	2	1.5	1.5	88.1
	20.3	1	.7	.7	88.8
	20.4	1	.7	.7	89.6
	21.0	2	1.5	1.5	91.0
	21.3	2	1.5	1.5	92.5
	22.4	1	.7	.7	93.3
	22.6	1	.7	.7	94.0
	24.7	1	.7	.7	94.8
	26.6	1	.7	.7	95.5
	27.7	1	.7	.7	96.3
	29.3	1	.7	.7	97.0
	30.9	1	.7	.7	97.8
	31.0	1	.7	.7	98.5
	33.7	1	.7	.7	99.3
	34.9	1	.7	.7	100.0
	Total	134	100.0	100.0	

Usage of alternative source

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Use	23	17.2	17.2	17.2
	No use	111	82.8	82.8	100.0
	Total	134	100.0	100.0	

Sharing water with neighbours

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	16	11.9	11.9	11.9
	No	118	88.1	88.1	100.0
	Total	134	100.0	100.0	

Service hours

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	1.5	1.5	1.5
	2	2	1.5	1.5	3.0
	3	10	7.5	7.5	10.5
	4	12	9.0	9.0	19.5
	5	13	9.7	9.8	29.3
	6	15	11.2	11.3	40.6
	7	3	2.2	2.3	42.9
	8	44	32.8	33.1	75.9
	9	5	3.7	3.8	79.7
	10	7	5.2	5.3	85.0
	12	20	14.9	15.0	100.0
	Total	133	99.3	100.0	
Missing	System	1	.7		
Total		134	100.0		

Customer's rating for water pressure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low	4	3.0	3.3	3.3
	Fair	81	60.4	65.9	69.1
	High	23	17.2	18.7	87.8
	Very high	15	11.2	12.2	100.0
	Total	123	91.8	100.0	
Missing	99	11	8.2		
Total		134	100.0		

Number of household members

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	1.5	1.5	1.5
	2	10	7.5	7.5	9.0
	3	18	13.4	13.4	22.4
	4	16	11.9	11.9	34.3
	5	16	11.9	11.9	46.3
	6	27	20.1	20.1	66.4
	7	16	11.9	11.9	78.4
	8	12	9.0	9.0	87.3
	9	6	4.5	4.5	91.8
	10	4	3.0	3.0	94.8
	11	1	.7	.7	95.5
	12	2	1.5	1.5	97.0
	13	3	2.2	2.2	99.3
	15	1	.7	.7	100.0
	Total	134	100.0	100.0	

Number of children in the house

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	23	17.2	17.2	17.2
	1	37	27.6	27.6	44.8
	2	25	18.7	18.7	63.4
	3	19	14.2	14.2	77.6
	4	16	11.9	11.9	89.6
	5	7	5.2	5.2	94.8
	6	4	3.0	3.0	97.8
	7	1	.7	.7	98.5
	8	1	.7	.7	99.3
	10	1	.7	.7	100.0
	Total	134	100.0	100.0	

Monthly payment for electricity bill

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tsh0	6	4.5	4.5	4.5
	Tsh1,000	4	3.0	3.0	7.5
	Tsh4,000	1	.7	.7	8.2
	Tsh5,000	69	51.5	51.5	59.7
	Tsh6,000	2	1.5	1.5	61.2
	Tsh7,000	2	1.5	1.5	62.7
	Tsh8,000	1	.7	.7	63.4
	Tsh9,000	1	.7	.7	64.2
	Tsh10,000	20	14.9	14.9	79.1
	Tsh13,000	1	.7	.7	79.9
	Tsh15,000	3	2.2	2.2	82.1
	Tsh20,000	5	3.7	3.7	85.8
	Tsh30,000	7	5.2	5.2	91.0
	Tsh40,000	2	1.5	1.5	92.5
	Tsh50,000	8	6.0	6.0	98.5
	Tsh60,000	1	.7	.7	99.3
	Tsh70,000	1	.7	.7	100.0
	Total	134	100.0	100.0	

Monthly payment for mobile phone

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tsh0	12	9.0	9.0	9.0
	Tsh100	2	1.5	1.5	10.4
	Tsh200	17	12.7	12.7	23.1
	Tsh400	1	.7	.7	23.9
	Tsh500	69	51.5	51.5	75.4
	Tsh700	1	.7	.7	76.1
	Tsh1,000	19	14.2	14.2	90.3
	Tsh2,000	4	3.0	3.0	93.3
	Tsh3,000	1	.7	.7	94.0
	Tsh5,000	5	3.7	3.7	97.8
	Tsh10,000	2	1.5	1.5	99.3
	Tsh50,000	1	.7	.7	100.0
	Total	134	100.0	100.0	

Monthly household income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tsh20,000	19	14.2	28.8	28.8
	Tsh40,000	7	5.2	10.6	39.4
	Tsh60,000	3	2.2	4.5	43.9
	Tsh80,000	3	2.2	4.5	48.5
	Tsh100,000	5	3.7	7.6	56.1
	Tsh120,000	2	1.5	3.0	59.1
	Tsh140,000	1	.7	1.5	60.6
	Tsh160,000	4	3.0	6.1	66.7
	Tsh180,000	7	5.2	10.6	77.3
	Tsh200,000	13	9.7	19.7	97.0
	Tsh300,000	1	.7	1.5	98.5
	Tsh400,000	1	.7	1.5	100.0
	Total	66	49.3	100.0	
Missing	System	68	50.7		
Total		134	100.0		

Satisfaction level for ZAWA's services

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very poor	1	.7	.8	.8
	Fair	68	50.7	52.3	53.1
	Good	47	35.1	36.2	89.2
	Very good	14	10.4	10.8	100.0
	Total	130	97.0	100.0	
Missing	99	4	3.0		
Total		134	100.0		