Novelty Journals

ISSN 2394-9694

International Journal of Novel Research in Humanity and Social Sciences
Vol. 5, Issue 5, pp: (139-159), Month: September - October 2018, Available at: www.noveltyjournals.com

INFLUENCE OF WATER KIOSKS PROGRAM ON WATER SUPPLY MANAGEMENT IN WAYANI, MOMBASA COUNTY

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Abstract: **An analysis of the relationship of water kiosks program and water supply management in Wayani, Mombasa County was conducted with the main aim of establishing if the accessibility, quality, affordability and reliability of water in Wayani are dependent on the number of water kiosks in the area, and their correlation. Millions of Africans are faced with severe water shortages due to uneven water distribution, poor water infrastructure networks and lack of good political will. This study brought forth the status of water supply and distribution in Mombasa County as it addressed causes of the perennial water shortages experienced in the County. The target populations were both water kiosks operators and household consumers in Wayani, leading to use of stratified sampling design which was used to divide members of the population into homogeneous subgroups. Primary data was collected using questionnaires embedded in the mWater portal while secondary data was collected from historical records. The research employed descriptive research design to report summary of data, which involved percentages, measure of central tendency standard deviation, correlation and regression analysis. Findings for accessibility revealed measure of central tendency of slightly high mean of 3.2 and 3.283 for the water kiosk operators and house hold consumers respectively. Pearson correlation revealed a high correlation coefficient of 0.9851 on the response pattern for the two paired datum. For reliability, measure of central tendencies of mean ranged between 3.28 and 3.283. Pearson correlation revealed a high correlation coefficient of 0.9197 on the response pattern for the two paired datum. For quality, measure of central tendency revealed a slightly low mean of between 2.614 and 2.684 for the water kiosk operators and house hold consumers respectively. Pearson correlation revealed a high correlation coefficient of 0.9084 on the response pattern for the two paired datum. For affordability, measure of central tendencies of mean ranged between 2.119 and 2.5 which indicate a generally low mean. Pearson correlation revealed a high correlation coefficient of 0.956 on the response pattern for the two paired datum. The study concludes that water kiosk program has significant effect on the water supply management in Wayani. Measures need to be put in place to ensure that the water kiosks boost accessibility, reliability quality and affordability of water in Wayani in order to successfully addressed causes of the perennial water shortages experienced in the County. It is recommended that more water kiosk programs and training and sensitization of the operators to assure quality of water should be done. The study concludes that indeed water shortage in Wayani is real and the local authority should take to task the specifications on standards and regulations of the water supplied by water kiosk operators as pertaining to quality, and affordability, as they ensure accessibility and reliability by increasing water volumes.**

Keywords: **Influence of Water Kiosks Program on Water Supply Management.**

ABBREVIATIONS AND ACRONYMS

CBO	Community Based Organisation
CGM	County Government of Mombasa
CWSB	Coast Water Services Board

GIS	Geographic Information System
GPS	Global Positioning System
GIZ	German Technical Cooperation
KES	Kenya Shilling
KNBS	Kenya National Bureau of Statistics
LIAs	Low Income Areas
LIC	Low Income Consumers
LICS	Low Income Consumers Services
MDGs	Millennium Development Goals
MOWASCO	Mombasa Water Supply and Sanitation Company
MWI	Ministry of Water and Irrigation
NGO	Non-Governmental Organisation
NRW	Non-Revenue Water
O&M	Operation and Maintenance
WSB	Water Services Board
WSUP	Water and Sanitation for the Urban Poor
WSTF	Water Sector Trust Fund

1. INTRODUCTION

Water crisis affecting world is one of major public health issues, close to 1.1 billion people lack access to potable water (Water Aid, 2012) roughly 20% of the world's population. Seckler (2001) argues that the scarcity of water is now the single greatest threat to human health, environment, and global food security. This problem is not limited to a particular region of the world but the crisis is more pronounced in developing countries, especially in Sub-Saharan Africa and South Asia especially due to uneven distribution of water, poor water infrastructure networks and lack of good political will.

The problem of water scarcity in urban areas of developing countries is a growing major concern. So dire is the situation that it is estimated that by 2050, half of India's population will be living in urban areas and will face acute water shortages (Singh, 2000). It was reported that by the year 2002, about 1.1 billion people were still using water from unimproved water sources, and two thirds of these people live in Asia. The population without improved water sources in a country like China alone is equal to the number of un-served people in the whole of Africa (UNICEF/ WHO, 2004). The quality of water that people receive is also compromised. It is estimated that in India, 85% of urban population has access to drinking water out of which only 20 per cent of the available drinking water meets the health and quality standards set by the World Health Organisation (WHO) (Singh, 2000). The daily rate of water supply in the developing countries is quite low compared to the developed or industrial world. In India for instance, it ranges from 16 to 300 litres per day depending on the locality and the economic strata (Singh, 2000), however this figure ranges from 100 to 600 litres per day in the developed countries. The populations that are unserved by piped water supply receive even smaller quantities of water. In East Africa, the daily supply rate of un-piped water was approximately a third less than for piped users of low-income communities in the informal settlements (Thompson et al., 2001).

The level of water stress in many developing countries is not only due to source limitation but other factors such as poor city water network infrastructure and inequalities in service provision between the rich and the poor (UN-HABITAT, 1999). The design of water distribution systems in general has assumed a scenario of continuous supply which in many instances is further from the reality. Nevertheless, in most of the developing countries, the water supply system is not normally continuous but intermittent. The Asian Development Bank reported that, in the year 2001, 10 of the 18 cities studied, supplied water for less than 24 hours a day (ADB, 2004).

It is becoming increasingly clear that population growth and urbanization will be one of the world's most important challenges in the next few decades. United Nations population prospects report (2006) depicts the higher rate of population growth in urban area in the developing countries. In less developed nations, urban population will grow from

1.9 billion in 2000 to approximately 3.9 billion in 2030, averaging 2.3% per year. Likewise, in developed countries, the urban population is expected to increase, from 0.9 billion in 2000 to 1 billion in 2030 translating to an overall growth rate of 1% (Brockerhoff, 2000). This unprecedented growth of urban populations has resulted in African cities having overcrowded, informal settlements characterized by inadequate housing, poor infrastructures such as water supplies, sanitation and waste management services. This is the result, in part, of the fact that most cities, both in developed and developing regions are experiencing a divergence of their populations into affluent and poor neighbourhoods. Modern trends are towards seclusion rather than social integration between rich and poor neighbourhoods (Chelala, 2010).

This is epitomised in many African cities, where local governments have been unable to keep up with the pace of change and consequently have also been unable to provide residents with proper infrastructures related to water and sanitation services provision and the collection, transportation, processing and disposal of waste materials. In developing countries characterized with economies under stress, waste management is a problem that often endangers health and the environment. Interestingly, it is a low priority problem for governments often besieged by other problems such as poverty, hunger, children's malnutrition, water shortages, unemployment and even war. It is therefore evident that fast-growing population, increasing poverty and its effects on living conditions are some of the problems facing cities in the developing world (Chelala, 2010).

The scarcity of water in Kenya is aggravated by unreliable and/or changing precipitation patterns, degradation of natural water resources and periodic droughts and perennial floods (UNICEF/WHO Water for life, 2010). Kenya has experienced tremendous population increases in the last 40 years. The annual population growth in Kenya was last reported at 3.03% in 2014 (World Bank, 2014). In 2009, it was indexed at 2.58% according to a World Bank Report of 2010. The annual population growth rate in Kenya was reported at 2.58% in 2008 (World Bank, 2011).It is noteworthy that urban growth has been at the rate of five per cent in the last forty years. In 1963, the urban population in Kenya was low at 8%. Currently 34% of the population lives in the urban centres. Projections show that by 2030, 50% of Kenyans will be residing in the urban areas (UN-Habitat, 2008).

Wayani is a Low Income Settlement in Mombasa County in Kenya that has experienced persistent water problems due to factors like fast population growth and poor maintenance of existing water supply infrastructure. Although Mombasa County is geologically rich in groundwater, exploitation is limited due to salinity because of seawater intrusion (Musingi, 2009). With a daily demand of 182,000 cubic meters in the county, Mombasa Water Supply & Sanitation Company (MOWASCO) is only able to meet 43,000 cubic meters per day (MOWASCO, 2014). This has led to inadequate provision of water services, with the poor in areas like Wayani, suffering the most. According to the MOWASCO Pro-poor Service Provision Capacity Assessment report (2014), a majority 65.8% of poor households in Mombasa County get water from water kiosks, 20.3% from pushcarts while only 4.7% have direct connection to the reticulation network. Evidently, the predominant water source in the Low Income Areas is the water kiosk. The same report asserts that, in Mombasa County, there are over 2,100 water kiosks in operation, out of which 98 percent are run by private entrepreneurs, while a few run by Community Based Groups.

The generally agreed definition of water kiosk is that it is outlet in which formal water providers deliver safe and reliable water at affordable prices to residents of low-income areas (World Bank, 2010). The design of the kiosks includes a provision to display information and sensitization materials, such as notices. Additionally, some of the kiosks are equipped with shelves and drawers that are stocked with retails wares for sale to residents. The kiosk operators often sell health products, such as condoms and soap, as well as groceries. There are also cases of kiosks being operated by tailors who set up their small yard inside. This all helps to ensure that water is sold at an affordable price while the kiosk operators earn sufficient income to make the venture an attractive business. It is estimated that 50 percent of the water kiosk operators are women, which makes this small-scale trade a particularly good activity for the promotion of income generation for women (Kenya Water Report, 2012).

Some water kiosks in Wayani are connected illegally to the MOWASCO water supply system mainly on high-pressure mains, directed to the storage tank. This massively reduces supply pressure (Njeru, 2012). According to MOWASCO (2015), the Non-Revenue Water (NRW) in Mombasa County stands at 54% of the total volume of treated water delivered from the sources. This is beyond the acceptable levels of 25%. Much of the NRW results from physical (detectable and undetectable) leakages while the rest is as a result of water theft and failure to bill, essentially as a result of meter-readers

collusion with consumers. The above reasons necessitate daily water rationing, sometimes lasting four days in a week. With this kind of rationing, the forces of supply and demand quickly translate into higher cost of water and proliferation of water kiosks that have invested in huge capacity storage tanks to resell water at exorbitant prices throughout the dry periods. This research, therefore, is necessary to determine the impact of water kiosks on Water Supply Management in Wayani, Mombasa County by assessing whether they are innovative gap fillers, as proponents claim, or an impediment to service delivery, as the skeptics argue.

Statement of the Problem:

Water scarcity problem is growing worse as the world's population increases and water supplies needed at household levels is also on the rise. In ability to access to clean water has already had a significant effect to the lives of many third of world's population and if not addressed can have serious effect on development (Harvard, 2008). Lack of clean water often forces people to obtain drinking water from unsafe sources. Unclean water dramatically increases the risk of developing diseases such as typhoid, cholera and dysentery.

Public water service providers in most of developing countries often serve only a fraction of the urban population, with the vast majority relying on alternate sources (Fass, 2008). The poor are disproportionately underserved or in some cases not served at all—poor households are almost never directly connected to the Water Service Providers and often rely on vending systems like water kioks that sell water by the bucket at very high unit prices (Crane 2004). Poor households often pay vendors far much more than the unit price paid by connected non-poor households to the utility, and they use only a fraction of the amount of water used by the connected. In some settlements, water vending is no longer a fringe activity, and water kiosks account for a large proportion of total water revenues.

Wayani estate has experienced an immense increase in uncontrolled residential development thus straining the ability of Mombasa Water Supply and Sanitation Company (MOWASSCO) to adequately supply water and sanitation facilities to the residents. The constitution of Kenya safeguards adequate access to water for all citizens as a basic human right. The reality, still, is far from the aspirations and entitlements of many Mombasa County urban residents particularly those in the uncontrolled settlements. The dynamics in Wayani estate are unique as the availability of water and sanitation is perceived as a luxury rather than a right. In Wayani, water scarcity means that a large population of women and children spend up to a third of their day searching or fetching water in the hot sun from the nearest fresh water source. This grueling work leaves the population exposed to serious dangers like exposure to attack by predators and susceptible to water borne diseases associated with lack of access to clean or good quality water and inadequate wastewater management (Munga 2002). This study therefore seeks to establish what relationship water kiosks have on water supply management in Wayani, Mombasa County.

Objectives of the study:

This study was specifically undertaken to:

i. To establish how the water kiosks program influences the accessibility of water in Wayani.
ii. To investigate the effect of the water kiosks program on water reliability in Wayani.
iii. To find out the effect of the water kiosks program on water quality in Wayani.
iv. To determine how the water kiosks program influences the affordability of water in Wayani.

Research Hypotheses:

This study intended to test the under listed hypotheses:

i. $H_0$1: There is no significant relationship between water kiosk program and water accessibility in Wayani.
ii. $H_0$2: There is no significant relationship between water kiosk program and water reliability in Wayani.
iii. $H_0$3: There is no significant relationship between water kiosk program and water quality in Wayani.
iv. $H_0$4: There is no significant relationship between water kiosk program and water affordability in Wayani.

Research Questions:

The study was undertaken to answer the questions below:

i. How does the water kiosks program influence the accessibility of water in Wayani?

ii. What effects does the water kiosks program have on water reliability in Wayani?

iii. What are the effects of the water kiosks program on water quality in Wayani?

iv. How does the water kiosks program influence the affordability of water in Wayani?

Definitions of Significant Terms:

Domestic Reseller: This is water selling household or informal water kiosk without a commercial license to sell water from the utility. It however has a domestic water account.

Kiosk Account: It is a unique reference number given to a particular water kiosk owner by water utility to ease description, transactions, business between the owner and the utility.

Kiosk Owner: The manager of a water kiosk has the possession rights.

Kiosk Operator: The person who tends to all the activities of selling water in a kiosk e.g. water Sales, record keeping, meter Reading, opening and closing the kiosk. Kiosk owner can also be the kiosk operator.

Non-revenue water (NRW): This is water which is supplied (produced and purchased) but not paid for. It includes technical losses (leakages and bursts) and commercial losses (water not billed due to illegal connections, inaccurate meter reading and billing, meter by passes and meter tampering).

Water Kiosk: This is described as an outlet through which water from a formal water provider is delivered safely and reliably to residents of low-income areas at affordable price. It is usually situated at a stationary location where water is sold or distributed by jerrycans or containers.

Water Service Provider or Utility (WSP): This can be a company, public benefits organization or other person or entity providing water services under and in accordance with a license issued by the Regulatory Authority for the service areas and terms defined by the license.

2. LITERATURE REVIEW

Overview of Water Supply Management:

In Kenya, water crisis is due to drought, inefficient management of the water supply, underinvestment, unfair allocation of water, extensive deforestation, pollution of water supply by untreated sewage and huge population (Njoki, 2010). Kenya is limited by an annual renewable fresh water supply of only approximately 647 cubic meters per capita and is now classified as a water scarce country (Kenya Water Report, 2012). Inadequate access to clean water leads to use of contaminated water that causes illnesses and death thus slowing down the economy and straining development. Thus, delivery of reliable supplies of water for drinking, washing and other needs is a basis to global sustainable development (Harvard, 2008).

Successful management and utilization of any resource requires accurate knowledge of the resource available, the uses to which it may be put, the competing demands for the resource, measures and mechanisms to evaluate the significance and worth of competing demands and measures to translate policy decisions into actions on the ground (Savenije, 2013). For water as a resource, this is mostly difficult since sources of water can cross many national boundaries and the uses of water include many that are difficult to assign financial value to and may also be difficult to manage in conventional terms.

Access to safe water and sanitation services is believed to be essential for health, security, livelihood, and quality of life, and is especially critical for women and children. Improved water supply and sanitation interventions could therefore provide a wide range of benefits: longer lifespan, reduced morbidity and mortality from various illnesses, higher school attendance, lower health costs, and less time and effort devoted to managing water and associated waste produced

(Fewtrell and Colfrod 2005). The time saved could allow women to engage in other more productive tasks. It could provide more time for childcare, socialization, and educational activities. The problem of inadequate access to water and sanitation exists both in rural and urban areas. However, for several reasons, the problem is particularly magnified in cities: Increasingly, this is where a large population of the poor live. Migration, both temporary and permanent, from impoverished rural areas to larger urban centers has usually promised large enhancements in welfare (Chowdhury, 2009), but these increases may be lessened by poor urban infrastructure. This study therefore breaks the aspect of water supply management into four entities: water affordability, water accessibility, water quality and water reliability.

Water Affordability and Water Kiosks Program:

Affordability is normally the concern when addressing the poor. Lack of affordability signifies the poor circumstances as the consequence of poverty. It is the factor that causes the poor to be less able to get access to basic needs. A study analysing affordability in transition countries showed that low-income households in most of those countries find affordability as a problem to pay their utility bills i.e. electricity, heating and specifically water bills (Fankhauser, 2007). Additional fact about water connection fee and even price per jerrican in Mombasa County is that the fee varies according to the distance of the house to the nearest supplying pipeline or even to the public utility or water kiosk.

To increase the affordability to the poor, water pricing and payment system need further attention from the service providers. Water pricing or water tariff should be best to reflect the production cost to guarantee full cost recovery to the provider. Though, the cost spent for the investment is often too expensive for the poor to be able to afford piped water. Consequently, subsidies offer an alternative view. The subsidy can be in the form of grant from government fund allocation or cross subsidy, and imposing higher tariff for the higher income customers. However, it should be noted that subsidising infrastructure development and water has been argued as not a pro-poor policy, as it was largely the middle classes that benefited (Brown, 2005).

The method of payment is an option of interest as well. The poor normally do not have secured income on a regular basis. In most cases, the poor obtain the income on a daily basis, thus daily purchase of water suits them better rather than monthly bills. The underprivileged people cannot afford to save the money to pay the monthly bill, as a largest limiting factor is that poor people cannot save (Rouse, 2007). This thinking then led to the idea to support the poor by releasing them from any obligation to pay in lump sum. One means is by applying payment in installments, the other means is prepaid system, where the consumer pays for the water for the amount that they can afford at the time like in the case of water kiosks. It provides the flexibility for the consumers to have the option of when to buy water, conserves the water through careful water usage and assure the revenue for the water service provider.

In general, water kiosk users in LIAs in Kenya pay significantly higher prices for the water. WSP (2012) associated this high price of water to the costs of establishing and operating the kiosks. The typical price of the water is eight times higher than the lowest block of tariff at domestic connections and four times higher than the average tariff in Kenya (WSP, 2012).

Water Accessibility and Water Kiosks Program:

According to Mitlin (2002), there are two issues regarding access. The first and perhaps the most important, is where the pipes are laid and how many low-income settlements are connected to the water supply. This brings forth the issue of the distance from the water source. Many parts of Mombasa County do not have access to piped connection as the result of the low coverage of water supply infrastructure. Spatial data shows that those parts without network access are usually poor community settlement (Bakker, 2008). Secondly, there is the question of connecting to the public network from the house (or living space) and the associated population using this public network. This brings forth the issue of the queuing time, which is, the time taken on the queue at the public utility in order to access water.

Low-income urban and peri-urban areas are the least served and are normally the last to receive any basic services such as drinking water supply from the water utilities (Snell, 1998). This is despite the areas being resident to majority of the population of the towns and cities. The failure by the government to provide basic services, especially drinking water, exposes the residents to undesirable exploitation by private water vendors and operators. Ultimately, the residents end up paying more for their drinking water needs, in terms of unit price, than the middle and high income class residents who basically have household piped water connection supplies (Le Blanc, 2008). Generally, standpipes and water kiosks are

medium priced and 'the next most expensive' to the high priced water supplied through 'water truckers, carters and carriers', with the household connection based on the volumetric tariff being the least expensive (Ringskog, 2012).

Private water connections are often inaccessible to the poor in Mombasa, either due to network being out of reach or the connection costs and monthly bills tending to be unaffordable. The result is high rates of disconnection or large arrears or sometimes both, leaving both the utility and poor consumers even worse off (Bahri, 2015). In such a case, water kiosks or selling standpipes become an appropriate choice for the poor where households pay for water by the bucket/jerry can as they collect.

Water kiosks are points for the sale of tap water and they are operated by either employees of utilities, by self-employed operators under contract with utilities, or by water committees consisting of volunteers and interest groups. Operators of water kiosks may also sell health and other products at the kiosk to increase their income (Williamson, 2007). Water Kiosks, where formal water providers supply safe water at affordable prices, have proven to be an appropriate and efficient solution, providing water to many residents in urban low-income areas like Wayani. Implementation of this low-cost technology is facilitated though multi-donor basket funds that provide pro-poor funding to commercial utilities (CUs), implementation support and in some cases post-implementation monitoring (Savenije, 2013).

Water Quality and Water Kiosks Program:

Water quality is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose. It is most frequently used by reference to a set of standards against which compliance, generally achieved through treatment of the water, can be assessed. The most common standards used to assess water quality relate to health of ecosystems, safety of human contact, and drinking water. Water quality is a measure of how suitable water is for a particular purpose. As a fact drinking water is of higher quality than seawater because seawater is unsuitable for drinking and irrigation due to the dissolved elements in it. The higher the water quality, the more applications it can be used for with minimal treatment. Water quality is also important for the protection of aquatic ecosystems. High levels of contaminants such as phosphorous, dissolved metals, and sediment can have an adverse effect on the productivity of aquatic plants and the health of fish and other organisms

Poor quality of the water sold at kiosks is one of the significant problems for the water kiosk system in LIAs. The contamination of the water occurs on two fronts; along the informal network due to inferior quality of materials used as pipe network and at the kiosk because of poor maintenance of the storage reservoirs coupled with unhygienic handling of the water. The very fact that kiosk operators lay pipes along existing channels, which include open sewers full of solid waste and polluted water coupled with the use of low quality plastic pipes allows contamination of water during its transportation from the utility network to the kiosks (World Bank, 2012). Most of the kiosk operators use low quality plastic pipes to reduce costs, as metal and higher grade plastic pipes are much more expensive and could be stolen and inherently because plastic pipes have the added advantage of being flexible enough to follow the winding and irregular paths found in most of the LIAs like Wayani in Mombasa County. This study therefore focuses on four aspects of water quality: turbidity (water colour), feacal colliform (contamination due to feaces) odour (smell) and salinity.

As in many other developing nationss, since the 1990s, Kenya has experienced large-scale migration to informally built, low-income urban areas. This growth in the urban population has not been matched by commensurate developments in Water Supply and Sanitation services (Alcamo, 2012). A key characteristic of the LIAs in Mombasa is that, many of the residents cannot afford to pay for and maintain a household connection. Houses in LIAs in Mombasa County are often leased out to more than one family, the owner of the property at times refuses to install a metered household connection, fearing that the water bill would not be paid or often, the physical infrastructure for the central water supply cannot be extended into low-income areas due to the high density of housing (Huisman, 2008). The above factors explain the continued mushrooming number of water kiosks in LIAs like Wayani in Mombasa County, which is the main area of focus of this study.

Water Reliability and Water Kiosks Program:

Water supply system reliability is the shortage that results due to failures of a system's physical components. A reliability factor for a single failure or for a selected period is the capacity lost during failure, which is measured as a fraction of the demand rate or the demand volume. Since the lost capacity is a random variable, so is the reliability factor, and its

probability density function is derived systematically from that of the lost capacity (Shamir, 2008). Reliability, for this study was analyzed using the frequency of supply and hours of supply, as, in many cases, water is not available throughout the day all week through the MOWASSCO network in Wayani. Reliability, defined as the probability that a given consistency factor will be achieved, can be increased by adding facilities, storage, pumping capacity, pipelines.

Compared to other utility companies like telecommunications and electricity, water production is very capital-intensive. Furthermore, assets used in water supply cannot be moved to another location and are generally unusable for any other purpose; they embody an extreme type of fixed capital, associated with sunk costs (Le Blanc, 2008). Komives and Foster (2005) showed that investments associated with capital costs in the network components of electricity and water services range from 70 percent to 90 percent of the total costs and these have asset life ranging between 20 years and 40 years. While the network components of telecommunication have a much lower level of capital intensity (25-45%) and substantially shorter asset life (10-20 years). They argued that it makes economical sense to invest more in water and electricity than in telecommunication, but this is not the case in developing nations, specifically, Kenya.

The urbanization in the large cities of the developing and third world world such as Dhaka, Mexico City, Sao Paulo, Cairo or Jakarta occurred during the post-1950 period, and the really explosive growth generally took place after 1960. These major urban areas simply could not deal with with the very high and continually increasing urbanization. They were not only unprepared to manage such explosive growths, but also they did not have the financial and management capacities to manage this work. Consequently, the overall quality of life declined rapidly during such periods of high urbanization. As noted earlier, between 1950 and 1975, the population of Mexico City increased more than fourfold, a significantly larger increase compared to what the urban centres of the developed world had witnessed previously. To a certain extent, many of these megacities could handle the provision of a water supply, but they largely fell progressively behind in developing, constructing and managing sewage and wastewater treatment facilities.

Theoretical framework:

The following section presents theories pertinent to the study as viewed by other scholars in relation to variables of this study.

Water Supply Reliability Theory:

This theory was developed in 1972 by Damelin, Shamir and Arad. It outlines the thoughts involved in assessing water supply reliability by developing a computer simulation model that is used to evaluate reliability for specific water supply systems and define a reliability factor in terms of shortages in annual delivery volumes. Since the system is subject to random failures of pumping equipment and of electric power supply, the reliability factor is a random variable.

The authors argued that a natural way of defining water supply system reliability is in terms of the deficits relative to the desired demand. They insisted that the demand of water may be considered in terms of the rate of supply required in units of discharge or in terms of the total volume to be supplied over a given period. Other considerations may relate to the number of failures per time, regardless of the length or extent of each and to the total duration of the failures during a period.

Together, these factors suggest the prospect that a short term loss of the entire supply may have a more serious effect than a longer term loss of only a portion of the capacity, even if the volume of the deficit is the same in both cases. Damelin, Shamir and Arad (1972) argue that water supply reliability may be improved by additional production capacity of sources, standby pumping capacity at pumping stations, additional storage, increased transmission capacity of the primary lines from the sources, additional pipelines in the distribution system and improved maintenance of pumps, pipes and other appurtenances.

Economic Theory of Water Pricing:

This theory outlines that the real value of an item to somebody is the “measure of what the item is worth to the individual, not what it costs” (Hanemann, 2006). It implies that the value is a subjective preference. It is imperative to note that the demand and the supply of a product are independent of one another. The demand shows how much the product is worth to people, the supply how much the product itself costs. The market price can be the result of the interaction between supply and demand as the point where the supply and demand curve intersect.

Through increasing the purchased quantity, the subjective value of the item decreases (e.g. the first bottle of water brings the most benefit) so that the demand curve generally declines. Consequently, the market price would have to decrease as well if the supplier is to maximize the consumed amount. This phenomenon is called "declining marginal value" and was first introduced by Depuit in the 1800. The slope with which the cost per unit rises also depends on the availability of the goods. In the case of the water sector, it depends on the availability of water sources and is characteristic of the condition of the water service providers (Agthe and Billings, 2003).

According to this theory, in the water and sanitation sector, the marginal price often increases with the rise in water consumption instead of declining (in contrast to companies that can profit from economies of scale), as the development of new sources costs a lot of money especially when no groundwater can be drawn and surface water bodies need to be commissioned. Additionally, the water price seldom declines, because the objective of the water sector is not the maximization of the demanded water quantity as this would lead to an unsustainable use of water.

Theory of Subsidies in Water Supply:

Though the creation of subsidies conflicts with the objective of economic efficiency and equity, they are employed in most water supply systems in developing countries, to decrease the inequalities in access to water supply between income groups. The decreased economic efficiency can create complications. Due to insufficient revenues, utilities are often financially weak and even the governmental funds cannot always meet all the subsidies they give to their customers. The resulting lack of money impedes the development of the supply network especially in the areas not yet serviced. A common consequence is that the unconnected households must get their water from different and sometimes more expensive sources (Komives, 2005).

In this theory, Whittington (2002) presents three criteria that are important for well-designed subsidies to avoid the mismanagement described in the previous paragraph. First, it must be evaluated who actually needs subsidies to prevent a needless loss of revenue. Indicators for the need of subsidies can be the percentage of income spent on water supply or results of willingness-and ability-to-pay studies. If genuine groups are distinguished, the tariff has to be altered in a way that those groups are targeted by the subsidies.

3. RESEARCH METHODOLOGY

Research Design:

This study employed descriptive research design. Descriptive research involves use of numbers and tables to describe, organize, summarize and present raw data (Hopkins, 1984). Descriptive studies report summary data such as measures of central tendency including mean, median, mode, deviation from mean, variation, percentage and correlation between variables. The combination of its characteristic summary and correlation statistic along with its focus on specific types of research questions, outcomes and methods is what differentiates descriptive research from other research types (Churchill, 2002).

The design is preferred because it allows for collection of quantitative data from a big sample from which data analysis is carried out to derive percentages and other central tendencies relationships. The researcher used regression equation data on the variables to study the relationship between the number of water kiosks and water supply management in Wayani, Mombasa County. This was done by establishing correlation coefficients between the number of water kiosks physically counted and those obtained from the available records and water quality, water price/cost, water reliability/availability and water accessibility in the area. Descriptive survey research designs are used in exploratory and preliminary studies to allow researchers to collect information and summarize, present and interpret data for the purpose of clarification (Orodho, 2003).

Target Population:

Cooper and Emory (1995) define population as the entire collection of elements about which the researcher wishes to make some inferences. An element is the focus on which the measurement is being taken and is the unit of the study. Population in statistics is the specific population about which information is desired. Wayani comprises 11 villages with 1233 households with a population size of about 6,500 people (Central Bureau of Statistics, 2016). Assuming one water kiosk serves about 100 people, then it is expected that there are about 65 water kiosks in the area.

Novelty Journals

ISSN 2394-9694

International Journal of Novel Research in Humanity and Social Sciences
Vol. 5, Issue 5, pp: (139-159), Month: September - October 2018, Available at: www.noveltyjournals.com

Table 3.1: Total Households per Village in Wayani

	Names	Number of Households
1.	Wayani	200
2.	Mwagosi	120
3.	St. Judy	65
4.	Chicago	70
5.	Refinery	55
6.	Mainland	150
7.	Santana	180
8.	Flamingo	50
9.	Getini	58
10.	Mwindani Hall	85
11.	Muoroto	200
	Total Number of Households	**1,233**

Source: CBS (2016)

Sample Size and Design:

There is need to sample the population since not all the population elements get water from kiosks as their main source. The study therefore used stratified sampling which is the process of dividing members of the population into homogeneous subgroups before sampling. The strata should be mutually exclusive: every element in the population must be assigned to only one stratum. For this study, the strata are two; namely, water kiosk operators and household consumers.

Table 3.2: Stratified Sample

Stratum	Population	Sample	Percentage Sampled
Water Kiosk Operators	65	20	30%
Household Consumers	1233	370	30%

Data Collection Instruments:

Questionnaires on m-Water portal were administered on households and water kiosks operators. The Secondary data is suitable for generating and collaborating information for the study from already documented data or available reports. Cooper and Schindler (2003) explain that secondary data is a useful quantitative method for evaluating historical or contemporary, confidential or public records, government opinions, reports and documents.

4. DATA ANALYSIS, PRESENTATION AND INTERPRETATION

Water accessibility and water kiosk program:

The first objective was to determine how the water kiosks program influences the accessibility of water in Wayani.

Table 4.1: Water accessibility in relation to water kiosk program (Response by Water kiosk operators)

Rating on effect of water kiosk vendor program	Frequency	Percent
Very accessible	1	5%
Accessible	6	30%
Sometimes accessible	10	50%
Rarely accessible	2	10%
Inaccessible	1	5%
Total	20	100%

1(5%) was of the opinion that water kiosk program has made water very accessible. 6(30%) of the respondents were of the opinion that water kiosk program has made water accessible. 10(50%) were of the opinion that water kiosk program has made water sometimes accessible. 2(10%) were of the opinion that water kiosk program has made water rarely accessible. 1(5%) were of the opinion that water kiosk program has made water inaccessible. From the above information, it is clear according to the opinion of majority that water kiosk program made water sometimes accessible. Rating of

occurrence ranked 1-5 (5 being very accessible) the mean was found to be 3.2 which indicated that water kiosk program had increased the accessibility of water in Wayani, and standard deviation 0.894.

Testing the hypothesis:

H_1 There is a significant relationship between water kiosk program and water accessibility in Wayani.

$$x^2 = \sum \frac{(O - E)^2}{E}$$

Likert scale	1	2	3	4	5
Observed (O)	1	6	10	2	1
Expected (E)	5	5	5	5	5

x_c^2 =15.5 > $x_{\alpha\ 0.05}^2$ =9.488 at 4 degrees of freedom and 95% level of significance

We therefore accept the alternative hypothesis that there is a significant relationship between water kiosk program and water accessibility in Wayani.

Table 4.2: Water accessibility in relation to water kiosk program (Response by House hold consumers)

Rating on effect of water kiosk vendor program	Frequency	Percent
Very accessible	37	10%
Accessible	101	27%
Sometimes accessible	181	48%
Rarely accessible	44	12%
Inaccessible	11	3%
Total	370	100%

37(10%) were of the opinion that water kiosk program has made water very accessible. 101(27%) of the respondents were of the opinion that water kiosk program has made water accessible. 181(48%) were of the opinion that water kiosk program has made water sometimes accessible. 44(12%) were of the opinion that water kiosk program has made water rarely accessible. 11(3%) were of the opinion that water kiosk program has made water inaccessible. From the above information, it is clear according to the opinion of majority that water kiosk program made water sometimes accessible. Rating of occurrence ranked 1-5 (5 being very accessible) the mean was found to be 3.283 which indicated that water kiosk program had increased the accessibility of water in Wayani, and standard deviation 0.904.

Using chi square testing to test the hypothesis;

H_1 There is a significant relationship between water kiosk program and water accessibility in Wayani.

$$x^2 = \sum \frac{(O - E)^2}{E}$$

Likert scale	1	2	3	4	5
Observed (O)	37	101	181	44	11
Expected (E)	74	74	74	74	74

x_c^2 =15.78 > $x_{\alpha\ 0.05}^2$ =9.488 at 4 degrees of freedom and 95% level of significance

We therefore accept the alternative hypothesis that there is a significant relationship between water kiosk program and water accessibility in Wayani.

Novelty Journals

ISSN 2394-9694

International Journal of Novel Research in Humanity and Social Sciences
Vol. 5, Issue 5, pp: (139-159), Month: September - October 2018, Available at: www.noveltyjournals.com

Water reliability in relation to water kiosk program:

The second objective was to establish how the water kiosks program influences the reliability of water in Wayani.

Table 4.3: Water reliability in relation to water kiosk program (Response by Water kiosk operators)

Rating on effect of water kiosk vendor program	Frequency	Percent
Very reliable	2	10%
Reliable	11	55%
Sometimes reliable	5	25%
Rarely reliable	1	5%
Unreliable	1	5%
Total	20	100%

2(10%) believed water kiosk program has made water very reliable. 11(55%) of the respondents were of the opinion that water kiosk program has made water reliable. 5(25%) were of the opinion that water kiosk program has made water sometimes reliable 1(5%) were of the opinion that water kiosk program has made water rarely reliable. 1(5%) were of the opinion that water kiosk program has made water reliable. From the above information, it is clear according to the opinion of majority that water kiosk program made water reliable. Rating of occurrence ranked 1-5 (5 being very reliable) the mean was found to be 3.667 which indicated that water kiosk program had increased the reliability of water in Wayani, and standard deviation 0.966.

Testing the hypothesis:

H_2 There is a significant relationship between water kiosk program and water reliability in Wayani.

$$x^2 = \sum \frac{(O - E)^2}{E}$$

Likert scale	1	2	3	4	5
Observed (O)	2	11	5	1	1
Expected (E)	4	4	4	4	4

x_c^2 =17.25 > $x_{\alpha\ 0.05}^2$ =9.488 at 4 degrees of freedom and 95% level of significance

We therefore accept the alternative hypothesis that there is a significant relationship between water kiosk program and water reliability in Wayani.

Table 4.4: Water reliability in relation to water kiosk program (Response by House hold consumers)

Rating on effect of water kiosk vendor program	Frequency	Percent
Very reliable	44	12%
Reliable	144	39%
Sometimes reliable	107	29%
Rarely reliable	56	15%
Unreliable	19	5%
Total	370	100%

44(12%) was of the opinion that water kiosk program has made water very reliable. 144(39%) of the respondents were of the opinion that water kiosk program has made water reliable. 107(29%) were of the opinion that water kiosk program has made water sometimes reliable 56(15%) were of the opinion that water kiosk program has made water rarely reliable. 19(5%) were of the opinion that water kiosk program has made water reliable. From the above information, it is clear according to the opinion of majority that water kiosk program made water sometimes reliable. Rating of occurrence ranked 1-5 (5 being very reliable) the mean was found to be 3.28 which indicated that water kiosk program had increased the reliability of water in Wayani, and standard deviation 1.03.

Novelty Journals

ISSN 2394-9694

International Journal of Novel Research in Humanity and Social Sciences
Vol. 5, Issue 5, pp: (139-159), Month: September - October 2018, Available at: www.noveltyjournals.com

Testing the hypothesis:

H_2 There is a significant relationship between water kiosk program and water reliability in Wayani.

$$x^2 = \sum \frac{(O - E)^2}{E}$$

Likert scale	1	2	3	4	5
Observed (O)	44	144	107	56	19
Expected (E)	74	74	74	74	74

x_c^2=138.35 >$x_{\alpha\ 0.05}^2$=9.488 at 4 degrees of freedom and 95% level of significance

We therefore accept the alternative hypothesis that there is a significant relationship between water kiosk program and water reliability in Wayani.

Water quality in relation to water kiosk program

The third objective was to establish how the water kiosks program influences the quality of water in Wayani.

Table 4.5: Water quality in relation to water kiosk program (Response by Water kiosk operators)

Rating on effect of water kiosk vendor program	Frequency	Percent
Very good quality	1	5%
Good quality	2	10%
Sometimes good quality	9	45%
Rarely good quality	6	30%
Not good quality	2	10%
Total	20	100%

1(5%) was of the opinion that water kiosk program has made water of very quality. 2(10%) of the respondents believed water kiosk program has made water of good quality. 9(45%) were of the opinion that water kiosk program has made water of sometimes quality 6(30%) were of the opinion that water kiosk program has made water rarely of good quality. 2(10%) were of the opinion that water kiosk program has not made water of good quality. From the above information, it is clear according to the opinion of majority that water kiosk program made water of sometimes good quality. Rating of occurrence ranked 1-5 (5 being very quality) the mean was found to be 2.684 which indicated that water kiosk program had lowered the quality of water in Wayani, and standard deviation 1.003.

Testing the hypothesis:

H_3There is a significant relationship between water kiosk program and water quality in Wayani.

$$x^2 = \sum \frac{(O - E)^2}{E}$$

Likert scale	1	2	3	4	5
Observed (O)	1	2	9	6	2
Expected (E)	5	5	5	5	5

x_c^2=9. 625>$x_{\alpha\ 0.05}^2$=9.488 at 4 degrees of freedom and 95% level of significance

We therefore accept the alternative hypothesis that there is a significant relationship between water kiosk program and water reliability in Wayani.

Novelty Journals

ISSN 2394-9694

International Journal of Novel Research in Humanity and Social Sciences
Vol. 5, Issue 5, pp: (139-159), Month: September - October 2018, Available at: www.noveltyjournals.com

Table 4.6: Water quality in relation to water kiosk program (Response by House hold consumers)

Rating on effect of water kiosk vendor program	Frequency	Percent
Very good quality	15	4%
Good quality	74	20%
Sometimes good quality	181	49%
Rarely good quality	67	18%
Not good quality	33	9%
Total	370	100%

15(4%) was of the opinion that water kiosk program has made water of very good quality. 74(20%) of the respondents were of the opinion that water kiosk program has made water of good quality. 181(49%) were of the opinion that water kiosk program has made water of sometimes good quality. 67(18%) were of the opinion that water kiosk program has made water rarely of good quality. 33(9%) were of the opinion that water kiosk program has not made water of good quality. From the above information, it is clear according to the opinion of majority that water kiosk program made water of rarely good quality. Rating of occurrence ranked 1-5 (5 being very good quality) the mean was found to be 2.614 which indicated that water kiosk program had lowered the quality of water in Wayani, and standard deviation 1.03.

Testing the hypothesis:

H_3There is a significant relationship between water kiosk program and water quality in Wayani.

$$x^2 = \sum \frac{(O - E)^2}{E}$$

Likert scale	1	2	3	4	5
Observed (O)	15	74	67	181	33
Expected (E)	74	74	74	74	74

x_c^2=270.54 >$x_{\alpha\ 0.05}^2$=9.488 at 4 degrees of freedom and 95% level of significance

We therefore accept the alternative hypothesis that there is a significant relationship between water kiosk program and water quality in Wayani.

Water affordability in relation to water kiosk program:

The fourth objective was to establish how the water kiosks program influences the affordability of water in Wayani.

Table 4.7: Water affordability in relation to water kiosk program (Response by Water kiosk operators)

Rating on effect of water kiosk vendor program	Frequency	Percent
Very affordable	1	5%
Affordable	2	10%
Sometimes affordable	10	50%
Rarely affordable	5	25%
Unaffordable	2	10%
Total	20	100%

1(5%) was of the opinion that water kiosk program has made water very affordable. 2(10%) of the respondents were of the opinion that water kiosk program has made water affordable. 10(50%) were of the opinion that water kiosk program has made water sometimes affordable 5(25%) were of the opinion that water kiosk program has made water rarely affordable. 2(10%) were of the opinion that water kiosk program has made water unaffordable. From the above information, it is clear according to the opinion of majority that water kiosk program made water sometimes affordable.

Rating of occurrence ranked 1-5 (5 being very reliable) the mean was found to be 2.5 which indicated that water kiosk program had increased the price of water in Wayani, and standard deviation 1.0.

Testing the hypothesis:

H_4 There is a significant relationship between water kiosk program and water affordability in Wayani.

$$x^2 = \sum \frac{(O - E)^2}{E}$$

Likert scale	1	2	3	4	5
Observed (O)	1	2	10	5	2
Expected (E)	5	5	5	5	5

x_c^2 =13.5 > $x_{\alpha\ 0.05}^2$=9.488 at 4 degrees of freedom and 95% level of significance

Thus, we accept the alternative hypothesis that there is a significant relationship between water kiosk program and water affordability in Wayani.

Table 4.8: Water affordability in relation to water kiosk program (Response by House hold consumers)

Rating on effect of water kiosk vendor program	Frequency	Percent
Very affordable	4	1%
Affordable	18	5%
Sometimes affordable	74	20%
Rarely affordable	196	53%
Unaffordable	78	21%
Total	370	100%

4(1%) was of the opinion that water kiosk program has made water very affordable. 18(5%) of the respondents were of the opinion that water kiosk program has made water affordable. 74(20%) were of the opinion that water kiosk program has made water sometimes affordable. 196(53%) were of the opinion that water kiosk program has made water rarely affordable. 78(21%) were of the opinion that water kiosk program has made water unaffordable. From the above information, it is clear according to the opinion of majority that water kiosk program made water rarely affordable. Rating of occurrence ranked 1-5 (5 being very reliable) the mean was found to be 2.119 which indicated that water kiosk program had increased the price of water in Wayani, and standard deviation 0.831.

Testing the hypothesis:

H_4 There is a significant relationship between water kiosk program and water affordability in Wayani.

$$x^2 = \sum \frac{(O - E)^2}{E}$$

Likert scale	1	2	3	4	5
Observed (O)	4	18	74	196	78
Expected (E)	74	74	74	74	74

x_c^2 =13.5 > $x_{\alpha\ 0.05}^2$=9.488 at 4 degrees of freedom and 95% level of significance

Hence, we accept the alternative hypothesis that there is a significant relationship between water kiosk program and water affordability in Wayani.

Table 4.9: Summary of Mean and Standard deviation computed for the variables.

Factors	Water kiosk operator		House hold consumers	
	Mean	SD	Mean	SD
Accessibility	3.2	0.894	3.283	0.904.
Reliability	3.667	0.966	3.28	1.03
Quality	2.684	1.03	2.614	1.017
Affordability	2.5	1.0	2.119	0.831

The mean calculated ranged between 2.119 and 3.684 stipulating a general high value response in the likert scale. Data was moreover analyzed with standard deviation which revealed homogeneity of response of the respondents thereby implying that there was a generally constant congruence between the independent variables and water kiosk program in Wayani.

Pearson Correlation Coefficient:

Pearson's correlation coefficient is a measure of linear dependence between two variables. The researcher correlated view of water kiosk operators against that of house hold consumers. The results are provided in Table 4.13.

Table 4.10: Correlation Analysis

Variable	Correlation coefficient on view of water kiosk operators against that of house hold consumers
Accessibility	0.9883
Sig (2 tailed)	0.002178
Reliability	0.9197
Sig (2 tailed)	0.027
Quality	0.9084
Sig (2 tailed)	0.0328
Affordability	0.956
Sig (2 tailed)	0.011006

Correlation analysis results between the view of water kiosk operators and house hold consumers on Accessibility of water attained a positive correlation coefficient of 0.9883 with a p-value of 0.002178. This was an indication that the result was significant at α= 5%, and the water kiosk operators response confirmed what the house hold consumers experienced. Result on reliability of water, attained a positive correlation of 0.9197 and a p-value of 0.027 which is significant at 5%. Quality of water attained a positive correlation of 0.9084 and a p-value of 0.0328. Affordability had a positive correlation of 0.956 and a p-value of 0.011. This meant that accessibility has the greatest correlation in terms of the opinion of the water kiosk operators and the house hold consumers while water quality has the least.

Focus Groups Discussions Results:

The findings from the FGDs confirmed that water kiosks program enhanced accessibility to water for the residents in Wayani. The consumers mentioned that the MOWASSCO water network had not covered the settlement adequately. To cover for this gap, water kiosks operators incurred costs of procuring pipes, fittings and labour to extend the water pipelines from the secondary lines into the settlements. It was said that in some cases, the kiosk operators had spent approximately KES 500,000 in the extensions including reservoirs to store water during rationing days. Even in parts of the settlements where there was a water network, consumers could still not afford to install household connections due to the costs involved. It was noted that for one to have a household connection, the first-time connection costs which included connection fees, account deposit, pipes, fittings and associated labour for installation was an average of KES 15,000. This was approximately 200% of the average monthl yincome and therefore rendered household connections out of reach for the consumers at Wayani.

Respondents also confirmed that the water kiosks program had increased the reliability of water in the sense that whenever a leakage occurred due to pipe bursts or old age of the pipelines, the kiosk operators would be quick to repair the same. In many cases, the operators responded faster to pipeline bursts than MOWASSCO staff. This was so because the operators depend on the sale of water to the consumers and any disruption of supply due to pipeline bursts would eat

into their volumes of sale hence profit. The operators who had invested in large tanks also guaranteed reliability in supply as they would sell the water stored in the tanks during no supply days due to water rationing by MOWASSCO. The water company only supplies water twice a week in Wayani LIA a factor which was attributed to the limited water supply received in Mombasa County against the huge demand of the commodity.

In terms of quality, the respondents, especially the consumers were not quite satisfied with the way the water kiosk operators handled water received from the mains supply. They claimed that the operators hardly cleaned their tanks periodically as should be the norm to ensure hygiene standards of water stored was not compromised. This allegation was confirmed when none of the water kiosk operators reported to have cleaned any of their tanks in the last 12 months. Further, due to low water pressure experienced at times, the operators were forced to excavate some shallow pits at the tap points in order to build some pressure and allow water to flow into the jerrycans. The pits became a source of contamination because stagnant dirty or storm water would collect in them.

Respondents confirmed that the water kiosks made water rarely affordable in Wayani. The gazette price of water as per the regulator, WASREB, is KES 2 per 20 litre jerrycan yet the consumers were paying av average of KES 5 for the same quantity. Considering the average household incomes of the residents of Wayani, this was quite expensive as it translated to approximately 40% of their incomes being spent on water alone.

5. SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings:

This section presents the results from the study on the influence of water kiosks program on water supply management in Wayani, Mombasa County, and it exemplified the relationship between the views of the water kiosk operators and that of house hold consumers.

1. Water accessibility in Wayani

According to the findings, majority of both the water kiosk operators and the house hold consumers were of the opinion that water kiosk program has made water sometimes accessible. The measure of central tendency revealed a slightly high mean of 3.2 and 3.283 for the water kiosk operators and house hold consumers respectively. This indicates that the water kiosk program increased significantly the accessibility of water in Wayani. Pearson correlation revealed a high correlation coefficient of 0.9851 on the response pattern for the two paired datum, which confirmed credibility of the respondent information about water accessibility in Wayani.

2. Water reliability in Wayani

The study established that water kiosk program has made water reliable in Wayani. Both the water kiosk operators and the house hold consumers had responses with measure of central tendencies of mean ranging between 3.28 and 3.667. This indicates that the water kiosk program increased significantly the reliability of water in Wayani. Pearson correlation revealed a high correlation coefficient of 0.9197 on the response pattern for the two paired datum, which confirmed credibility of the respondent information about water reliability in Wayani.

3. Water quality in Wayani

Findings on study of water quality revealed that majority of both the water kiosk operators and the house hold consumers were of the opinion that water kiosk program has made water sometimes of good quality. The measure of central tendency revealed a slightly high mean of between 2.614 and 2.684 for the water kiosk operators and house hold consumers respectively. This indicates that the water kiosk program reduced significantly the quality of water in Wayani. Pearson correlation revealed a high correlation coefficient of 0.9084 on the response pattern for the two paired datum, which confirmed credibility of the respondent information about water quality in Wayani.

4. Water affordability in Wayani

The study established that water kiosk program has made water rarely affordable in Wayani. Both the water kiosk operators and the house hold consumers had responses with measure of central tendencies of mean ranging between 2.119 and 2.5. This indicates that the water kiosk program reduced significantly the affordability of water in Wayani. Pearson correlation revealed a high correlation coefficient of 0.956 on the response pattern for the two paired datum, which confirmed credibility of the respondent information about water reliability in Wayani.

Discussion of Findings:

The findings on the influence of water kiosks program on water supply management in Wayani, Mombasa County are in tandem with Sharma (1989) who posit that success in water generating programs indicates commitment to municipal authorities and reduces production cost, enhances the easy and wider diffusion of trade and development, enlarges markets and encourages more innovations to business in a community. The findings is further in line with Goel's (2002) assertion that most developed countries invest in utility infrastructure to help develop or sustain other projects. Accordingly, World Bank (1994) highlighted that there is a close relationship between infrastructure and economic growth. The findings on water kiosk program on water supply management in Wayani, is in agreement with Udderwood (2010) who argues that the vital role utility infrastructure plays in the development of the society, stimulating not only the economy but society's socio-cultural values.

Findings on accessibility conform to Sangh's (2010) argument that delay and scarcity of utility items could be inherent in terms of poor support to underlying community. Accordingly, Riley, (2010) asserts that poor reliability in utility commodities with no predictable consistency schedule will lead to cost overruns in community businesses, schedule delays, poor quality, and a final result that is not acceptable. Correspondingly Bayot (2005) argues that quality of utility items could be an indicator of Local authority standards and recommended practices. It was clear according to the opinion of majority that water kiosk program made water of sometimes good quality. The quality of water is vital for the health and general well-being the residents of Wayani.

Berkoff (2007) argues that water price is not designed to increase in the same manner as other consumer items so as to allow economic pricing to be charged for an incremental capacity because water is treated as an intermediate good. Most water supply system is built to meet ordinary water requirements for a designated municipal community and expanding the distribution channel should not simply justify increment in price for the local citizen. High pricing hinders opportunity cost for the local residents

Conclusion:

The local authority should ensure accessibility of water to guarantee accessibility so as to strengthen other projects and spur economic growth in Wayani. A utility water supply system will be sustainable only if it encourages efficiencies in both the water kiosk operators and the house hold users. Both parties are in agreement that the accessibility of water kiosk program are averagely good though a lot needs to be done to make water further accessible to the local residents.

The reliability of water should be strengthened using the water kiosk program and other viable water projects to spur economic growth in Wayani. A utility water supply system will be sustainable only if it encourages efficiencies in both the water kiosk operators and the house hold users. Both parties are in agreement that the reliaibility of water kiosk program are averagely good though a lot needs to be done to make water further reliable to the local residents by increasing the water capacity and frequency of availability.

The quality of water should not be compromised on by the water kiosk program as this may affect the health and well being of the Wayani residents. A utility water supply system will be of good quality only if it meets the standards prescribed by the Kenya Bureau of Standards. Both parties are in agreement that the quality of water kiosk program is averagely good though a lot needs to be done to increase the rating of the water.

The pricing of water as presented by water kiosk program should be regulated to minimize exploitation of the local residents of Wayani by the water vendors. A utility water supply system will be affordable only if it can comfortably be accessed by the lowest income earners among the residents. Both parties are in agreement that the affordability of water kiosk program is averagely good though a lot needs to be done to make water further affordable to the local residents.

In summary, a utility water supply system will be sustainable only if it encourages efficiencies in both the water kiosk operators and the house hold users. Both parties are in agreement that the services of water kiosk program are averagely good though a bit lower quality and more expensive. But a lot can be done to improve the rating of the variables in this study. Initiatives to meet demand for water supply will be sustainable if they prioritize measures to avoid wastage of water. Avoiding wastage will significantly add to reducing water consumption and, consequently, enhance accessibility and reliability to the legal users. On the reliability, the acceptance and use of water efficient technology can considerably

reduce water consumption leading to more accessibility and affordability. Investments in less capital intensive water industrial processes and more efficient buildings lead to a more sustainable water supply. Sustainable water supply program involves a sequence of multifaceted actions and not isolated strategies. It depends on the individual's willingness to save water, changes in the building industry, industrial processes reformulation, governmental regulations, land occupation, and many more. The challenge is to create mechanisms of regulation, affordability and incentives to ensure the sustainability of the system.

Recommendations:

The study has revealed the significance of water kiosk program in relation to its contribution to water supply management in Wayani, Mombasa. In order to avail adequate physical infrastructure to facilitate water kiosk program in the country, proper assessment of systems need to be developed with a view to regulate the reliability, accessibility, quality and affordability of water in Wayani. These may be developed by governmental institutions, non-governmental institutions, and sometimes in collaboration with academia. Technology is usually the most crucial factor determining governmental utility project performance. In this regard, the thesis recommends the adoption of more advanced technology to supplement the water kiosk program to aid not only in basic water distribution but also provide complex information systems such as point to point areas of water loss and illegal connections with distributed, multi-functional indications that can easily generate information necessary to make decisions, improve the mentioned independent variables among others.

The issues that will guarantee the water sold at the water kiosks is of good quality and affordable are well addressed in the MOWASSCO Water Kiosks policy and Mombasa County Water and Sewerage Services Act 2016. If these two are well implemented and compliance to the same adhered to, the Water Kiosk Program will be a very good model of service delivery especially in the LIAs where settlements are unplanned with limited spaces to construct the conventional water supply network.

The Water kiosk program personnel are also crucial determinant in the success thereof. Adequate training and development is therefore crucial on matters relating to pertinent water program development concepts based on the personnel's training needs identified by a training needs assessment so that the time and money invested in training and management development is linked to the core variables or goals of the water kiosk program. These training and development programs would best integrate crucial up to date developments in the context of water kiosk program upon which generic and redundant concepts and practices would be separated and the beneficial outcomes on water kiosk program embraced.

REFERENCES

[1] Alcamo, G. (2012) *Environmental Problems and the Urban Household in the Greater Accra Metropolitan Area (GAMA) – Ghana.* Stockholm Environment Institute,Stockholm.

[2] Agthe, C. and Billings, M. (2003) Independent Water and Sanitation Providers in African Cities.*Economic theory of Water Pricing 2(6): 112-115.*

[3] Marianne, K. (2010) Complementary water systems in Dar es Salaam, Tanzania: the case of water vending, *Water Resources Development* 16(1): 143–154.

[4] Bakker, K. (2008) Archipelagos and networks: urbanization and water privatization in the South, *The Geographical Journal* 169(4): 328–341.

[5] Bahri, J. (2015) *Water Supply and Sanitation in the Health Sector in the Asia Region: Information Needs and Program Priorities.* Report to USAID. University of North Carolina, Chapel Hill, USA.

[6] Borg, H. and Gall, Q. (1989) Urban water management problems in developing countries with particular reference to Bangladesh, *Water Resources Development* 16(1): 21–33.

[7] Brockerhoff, M.P. (2000) *An Urbanizing World*. Population Reference Bureau (PRB), 55, 1-48.

[8] Brown, S. (2005) Water supply and the urban poor. In: Hardoy, J. E., Cairncross S. and Satterthwaite D. (eds) *The Poor Die Young*, pp. 109–126. Earthscan, London.

[9] Chelala, C. (2010) Challenges of Providing Water and Sanitation in Modern Urban and suburban Settings

[10] Churchill, A. (2002) "Standards Bureau approves four 'bottled' water manufacturers", Markets & Economy, *Business Times* Friday 12 May, Kenya.

[11] Chowdhury, S. (2009) Water vending in urban Kenya.*Water Resources Development* 7(4): 267–273.

[12] Cooper,S. and Emory R. (1995) Water markets, market reform and the urban poor:Results from Jakarta,Indonesia, *World Development* 22(1): 71–83.

[13] Conan, H. (2003) *Scope and Scale of Small Scale Independent Private Water Providers in 8 Asian Cities*. ADB/RETA.

[14] Conan, H. and Paniagua, M. (2003) *The Role of Small Scale Private Water Providers in Serving the Poor.* ADB

[15] Damelin, G., Shamir, P. and Arad, M. (1972) *The Citizens at Risk. From Urban Sanitation to Sustainable Cities*. Earthscan, London.

[16] Mathur, P and Thakur, S. (2003) *Urban Water Pricing*: Setting the stage for Reforms. UNDP India.

[17] Arthur, M. (2006) *Asian Water Supplies. Reaching the Poor.* Asian Development Bank and International Water Association.

[18] Fang, A. (2006) *Water resources constraint force on urbanization in water deficient regions:* A case study of the Hexi Corridor, arid area of NW China.

[19] Hopkins, T. (1984) Gender and wetlands management: issues and challenges in Southern Africa,*Gender and Water Resources Management*. Stockholm, 1–3 December 1993, Sida.

[20] Kothari, C. (2004) The everyday exploitation of women: housework and the patriarchal mode of production, *Women's Studies International Forum* 19(3): 221–237.

[21] Manion, S. and, Morrison, T. (2007) Public–private partnership in water supply and anitation in Sub-Saharan Africa, *Health Policy and Planning* 2(1): 70–79.25

[22] Musingi, N. (2009) *Gender Planning and Development: Theory, Practice and Training*. Nairobi, Kenya.

[23] Njoki, C. and Albu, M. (2004) Improving access to water through support to small water providing enterprises, *Small Enterprise Development* 15(2): 30–36.

[24] Orodho, C. (2010) Gender and the environment: the challenge of cross-cutting issues in development policy and planning, *Environment and Urbanization* 4(1): 134–149.

[25] UNDP (2012)–World Bank Water and Sanitation Program, Developing Countries. (http://www.wsp.org/pdfs/ af_providers.pdf)

[26] UN-HABITAT (2003) *Water and Sanitation in the World's Cities. Local Action for GlobalGoals*. Earthscan, London.

[27] Katko, T. S. (1991) Reselling and vending water, *Journal of the American Water Works Association* 83(6): 63–69.

[28] Kjellén, M., Bratt, A. and McGranahan, G. (1996) *Water Supply and Sanitation in Low and Middle Income Cities: Comparing Accra, Jakarta and São Paulo.* Urban environment Series 1. Stockholm Environment Institute, Stockholm.

[29] Komives, K., Whittington, D. and Wu, X. (2000) *Infrastructure Coverage and the Poor: a Global Perspective*. Infrastructure for Development: Private Solutions and the Poor,London, UK, 31 May – 2 June 2000.

[30] Lovei, L. and Whittington, D. (1993) Rent-extracting behavior by multiple agents in the provision of municipal water supply: a study of Jakarta, Indonesia, *Water Resources Research* 29(7): 1965–1974.

[31] McGranahan, G., Njiru, C., Albu, M., Smith, M., and Mitlin, D. (2006), *How small water enterprises (SWEs) can contribute to the Millennium Development Goals: Evidence fromAccra, Dar Es Salaam, Khartoum and Nairobi*, WEDC, Loughborough University,Loughborough, UK.

[32] McGranahan, G. and Owen, D. L. (2006), *Getting Local Water and Sanitation Companies to improve Water and Sanitation Provision for the Urban Poor*, Human Settlements Discussion Paper: Water-4, International Institute for Environment and Development, London.

[33] Njeru, M. (2012) *Drawers of Water II. 30 Years of Change in Domestic Water Use & Environmental Health in East Africa. Tanzania Country Study*. IIED, London.

[34] Shugart, C. (1991) *An Exploratory Study of the Water Standpipe – Vendor System in Jakarta* Harvard Institute for International Development, Harvard.

[35] Snell, S. (1998) *Water and Sanitation Services for the Urban Poor. Small-Scale Providers:Typology & Profiles.* UNDP–World Bank Water and Sanitationrogram,Washington.

[36] Surjadi, C., Padhmasutra, L., Wahyuningsih, D., McGranahan, G. and Kjellén, M. (1994)*Household Environmental Problems in Jakarta.* Stockholm Environment Institute, Stockholm.

[37] Swyngedouw, E. A. (1995) The contradictions of urban water provision: a study of Guayaquil,Ecuador, *Third World Planning Review* 17(4): 387–405.

[38] Thompson, J., Porras, I. T., Tumwine, J. K., Mujwahuzi, M. R., Katui-Katua, M., Johnstone, N and Wood, L. (2001) *Drawers of Water II. 30 Years of Change in Domestic Water Use & Environmental Health in East Africa. Summary*. IIED, London.

[39] Porras, I. (2002) Diarrhoea and effects of different water sources, sanitation and hygiene behaviour in East Africa, *Tropical Medicine and International Health* 7(9): 750–756. Water Utility Partnership (2001–2003) *"Toolkit. A Practitioner's Companion."* The Water Utility Partnership.

[40] White, G. F., Bradley, D. J. and White, A. U. (1972) *Drawers of Water: Domestic Water Use in East Africa*. University of Chicago Press, Chicago.

[41] Whittington, D., Lauria, D. T. and Mu, X. (1991) A study of water vending and willingness to pay for water in Onitsha, Nigeria, *World Development* 19(2/3): 179–198.26

[42] Whittington, D., Lauria, D. T., Okun, D. A. and Mu, X. (1989b) Water vending activities in developing countries: a case study of Ukunda, Kenya, *Water Resources Development* 5(3): 158–168.

[43] WHO and UNICEF (2000) *Global Water Supply and Sanitation Assessment 2000 Report.*World Health Organization and United Nations Children's Fund.

[44] World Water Assessment Programme (2003) *Water for People. Water for Life. A Joint Reportby the Twenty-three UN Agencies Concerned with Freshwater.* United Nations Educational, Scientific and Cultural Organization (UNESCO) and Berghahn Books.