ASSESSMENT OF FACTORS INFLUENCING SUSTAINABILITY OF PERIURBAN WATER SUPPLY PROJECTS

A SURVEY OF NYAHURURU SUB-COUNTY, KENYA

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Abstract

The supply of clean water continues to be problematic in most urban areas of Kenya, because of the steadily increasing population. This study assessed factors (financial capacity, human resource capacity, technological capacity and management support) influencing sustainability of peri-urban water supply projects in Nyahururu sub-county. Descriptive survey research design was employed with a target population of 76 employees working in the water supply sector. Stratified random sampling was used to select 64 respondents. Data was collected through semi-structured questionnaires, and processed using SPSS 20 for descriptive and inferential analysis. A response rate of 93.8% was achieved. On maintaining water distribution infrastructure, majority were neutral. Human resource capacity is important (mean of 4.12) while prediction of market trends and planning was below average (mean 2.27).Continuous improvements of services should be enhanced (mean 2.45). Inferential analyzes revealed a strong positive correlation among all the four variables e.g. financial capacity r=.759. The regression analysis explained only 58.6% of the factors. This study recommended budgeting for technology adoption and building more investment funds to improve the level of sustainability.

Keywords: Sustainability; Budgeting; Finance; Project Management; Support; Technology; Human resource

INTRODUCTION

The supply of clean water has been and continues to be a problem in most peri-urban areas of Kenya. Water supply still remains relatively constant or increases insignificantly though water needs are growing (Techneau, 2006). Declarations to reduce by half the proportion of people without sustainable access to safe drinking water by 2015 has not been realized (UN, 2000).However, progress has been made towards meeting the water supply needs for the world's poor. In 2002, 79% of the population in developing countries had access to improved water supplies, bringing up the total world coverage to 83%.With over 75% of the Africa's poor living in rural areas the need to expand sustainable water service to these areas is imperative (De Regt 2005). The recognition by the UN General Assembly, in 2010, of water and sanitation as a human right provides additional political impetus towards the ultimate goal of providing everyone with access to these vital services. Moreover, nearly 10% of the total burden of disease worldwide is attributable to unsafe water, sanitation, and hygiene and the associated diseases that claim 3.6 million lives annually (Pruss-Ustun et al., 2008). As a result, a lot of interest has been built on performance and sustainability of water supply projects. The supply of safe water must be prioritized through a strategic approach by the government of every state or nation(ADB, 2009). Key resources like finance, technology and human resources must be made available to ensure consistency and efficiency in water supply operations. In Africa, the issue of supply and access to safe drinking water is a serious issue in rural and semi-urban areas. Hayson (2006) studied factors affecting sustainability of rural water supply companies in Tanzania and identified major research gaps in the role of technology and social factors. Global Water Initiative-East Africa reported governance as a factor in sustainability of regional rural water suppliers(Welle, 2014). More than 80 per cent of Kenya's population live in the rural areas and according to the WHO/UNICEF Joint Monitoring Programme Report 2012, only 52 per cent of the population living in rural Kenya had access to improved drinking water sources as compared to 82 per cent of the urban population in 2010. The national average is 59% but current rural coverage is below 50% and attributes this low coverage to the type of water sources (NWP, 2012).

The African Ministers Council on Water (AMCOW) puts coverage in Kenya at only 42% in 2010.Inadequate and poor quality water and sanitation coupled with poor hygiene practices have contributed to high infant and under five mortality rates - 55 and 74/1000 live births respectively in Kenya (KDHS 2009)). It is estimated that diarrheal diseases caused about 20% of these deaths (KDHS 2008-2009, NCAPD 2010).Steady population growth in Kenya has not been in tandem with increase in access to clean water supply. Human activities such as deforestation, pollution of water bodies, poor management of rain water and misuse of water

affects access to clean water e.g. deforestation of the Mau Complex leading to loss of natural biodiversity by individual land uses. Poor rain water management is blamed for more than 90% loss of rain water, especially in semi-arid arid areas through evaporation and water pollution making it unfit for human and animal consumption or use (Onsomu et al., 2013). Because of the inefficiencies in water supply, the government of Kenya came up with reforms in the water sector to address the policy, regulation and service provision inefficiencies. However, these efforts have not been sufficient. The new Water Act which was passed in 2002 opened the sector to numerous institutional changes, including decentralized water provision. As a result, in urban areas for instance, the large number of private water suppliers has steadily increased in the past (OECD task force, 2008).

The cost for starting new projects as well as the cost of establishing new a connection to peri-urban region is very high (Agriculture Environment and Natural Resource Committee, 2015). Because of the high costs, management and expansion of water supply projects becomes a challenge to many local authorities (Nothern Western Service Board, 2015). These costs are mostly transferred to the final consumers leading to higher water tariffs such that low income earners are not able afford. Sustainability is desirable for cost considerations, optimal environmental, economic and social benefits. In addition, sustainability leads to long term technical, financial and managerial capacity enhancement (United States Environmental Protection Agency, 2015). Similarly, Buy Smart Network (2015) categorized the benefits of sustainability into: financial benefits, management benefits, environmental benefits and socio-economic benefits.Long term sustainability in water infrastructure should therefore be the foundation for expanding existing water distribution and building new ones (Duffy, 2013). It is the responsibility of water supply organizations to offer safe, reliable and affordable water services at reasonable cost and continuously (Ofwat, 2015). Sustainability in management is the performance of an organization against environmental, social and government regulations (Javani, 2013).When an organization is unable to contain internal operations and costs, it becomes expensive to run. According to United States Environmental Protection Agency (2015), to achieve sustainability, effective planning is necessary. Sustainability in water supplying organizations is achievable through cost-effective life cycle analysis. Planning is important in making decisions on infrastructure investments, resource utilization and alignment of organizational goals with community goals. In addition, planning should incorporate waste water management into water supply infrastructure to enhance water supply and management operations (BuySmart Network, 2007). This study assessed Nyahururu Water and Sanitation Company (NYAHUWASCO). The company has a noble mission to supply safe and clean water but has been unable to reach and serve the peri-urban population adequately. To supplement

the supply capacity of NYAHUWASCO, water projects such as Igwamiti water springs, LeshauKaragoini and Gatimu among other water projects have been developed. Nyahururu sub-county is in Laikipia County.

Statement of the Problem

The need for enhanced access to clean piped water is as important as safe water supply in maintaining public hygiene and providing a sanitary environment. It is the mission of the government to ensure all citizens have access to clean and adequate water. Access to water and sanitation is a basic human right that demands the participation of the citizen and stakeholders in decision making at all levels. Despite the national strategic objectives to reach at least 50% of the underserved urban population with safe and affordable water by 2015, research reveals that most providers of water have not in practice set any priority to provide water to peri–urban regions. The few that have set such priorities such as NYAHUWASCO (2015) have not achieved much as far as implementation is concerned. It is therefore clear that there are challenges such organizations face in achieving the set objectives. This study endeavored to investigate the factors affecting sustainability of water supply projects in the peri-urban areas of Nyahururu sub-county.

LITERATURE REVIEW

Theoretical Literature

The study utilized the theory of constraints to identify obstacles or bottlenecks in the sustainability of water supply projects. Constraints are factors which limits water supply projects from achieving higher performance levels (Gupta, 2008). According to Goldratt (1984), organizational performance is affected by constraints or restrictions in their operations. Water service providers experience several constraints: financial, infrastructural, human resource and technology among other factors (Angel, 2009).Strategies should therefore be formulated to overcome such constraints (Mabin, 1999). Therefore, identifying, ranking and measuring criteria for constraints should be put in place. This will enable the organizations or projects to address the urgent constraints first to achieve improved performance. While addressing constraints, communication and stakeholder involvement approaches must be integrated into the process. The external resources affect the behavior of the organization in executing projects or its performance. The resource dependence theory was also used to assess the power of resource availability for sustainability of the water projects. Just as organizations are dependent on resources for survival that ultimately originate from the environment so are the projects. The resources one organization needs are thus often in the hand of other organizations. Resources

are a basis of power and legally independent organizations can therefore be dependent on each other (Chapman et al. 2011). For any organization to achieve sustainability resources are indispensable and resources comes in the form of human resource, finances, technology and stakeholder involvement including land.According to Harvey and Reed (2007), participation of project beneficiaries' is of great essence. It boosts the sense of ownership and ensures that projects are operated and maintained after the implementation phase. Community participation is attained through collaborative or joint involvement of project beneficiaries and the implementing agencies (Khwaja, 2004). The real value of participation stems from the finding that mobilizing the entire community, rather than engaging people on an individualized basis for more effective results (Braithwaite et al., 1994). Change is more likely to be successful and permanent when the people the water supply projects affect are involved in initiating, promoting and implementing them (Thompson et al, 1990).In this research, stakeholder participation at all levels is very critical to achieve water supply sustainability.

Empirical Literature

Financial resources are critical in the smooth running of any organization including water service providers to put into place new infrastructure and rehabilitation of existing ones. This helps maintain service quality over time (Angel, 2009).The effective operation and maintenance (O & M) of rural water supply systems is a crucial element for the sustainability of the water project. This becomes successful if financing resources available and frequent supports are provided (Binder, 2008). Budgeting sufficient funding for rural water supply systems is an important issue for sustainability and proper maintenance but not the only one.

Financing is always a problem especially for governmental and non-profit making organizations. It is more severe in developing countries especially in poor regions. Progress towards achieving water projects and water supplying organizational targets has been disappointing due to insufficient and poor management of financial resources (WHO-UNICEF (2008).

For all Kenyans to have access to clean and adequate water, significant increase in financing is required (Ministry of Water and Irrigation, 2014). World Health Organization (WHO) report estimates that USD 18billion will be needed annually to meet growing water needs. Organizations must also ensure to put in place a good financial management system that maintains financial health of the water supply companies (Romano, 2013). The system must be capable to determine operational budgets, sources of funding and their sustainability in running the business (Adlabay, 2008). The necessary financial documents and information needed by investors and creditors to access finances must be well documented (Sabates et al., 2005). In

addition, operations and maintenance costs are the major cost components in management of water organizations accounting for up to 95 % of company expenses of water companies (Onsomu, 2013). According to Romano (2013),financial factors are the major determinants of performance of water service companies. Occasional selling of water does not generate sufficient income to sustain water supplying organizations and operations. A study conducted in Moldova revealed that tariffs could only cover about 50% of operations. Cost benefit analysis is important in management of water supplying organizations or projects (Techneau, 2006). It allows comparison of alternative strategies based on cost implications and anticipated benefits. To achieve this, the national government must develop statutory water bodies mandated to control water supply (Department for Environment, Food and Rural Affairs, 2004).

The success of an organization largely depends on its human resource skills and capability. It is necessary to create new, modern and quality human resources that may effectively accomplish the goals of the water supply projects (Delaney et al., 1996). The competitive position of any organization equally depends on the kind of work force it has. This is also true for all projects including water supply projects. Development of human resources therefore becomes a daily affair of the organization (Harris, 2006). SOnsomu et al. (2013) argues that staff productivity is the output per staff over a given time period and is important in establishing efficiency of employees and in turn the entire system. Staff number has been found to be inversely related to operational performance while staff skills and ability are directly related to performance. Human resources are the intangible and invisible capital (intellectual capital) without which tangible assets in the water supply projects may not make any economic sense (Guerrinin, 2011). Organizations that invest on employee development and empowerment are seen to be more proactive and effective in responding to market needs and satisfying customer needs (Neo et al., 2003). Moreover, capacity building of the employees cannot be overlooked in water supply reforms(Asian Development Bank, 2009).

Technological advancement affects the efficiency and performance of all organizations and therefore the impact of technology cannot be overlooked (Young, 2007). Because of the ever-changing market needs, trends and the very dynamic environmental factors, adoption of appropriate technology can give water supply companies a competitive edge(Leonardi, 2010). Technology advancement in communication has broken boundaries turning the world into a global village. It has given new ways of professional and technical personnel operations in organizations of all levels. As a result, water service providers should open up to technology to improve planning, executing and managing projects. They have opportunities to develop highly specialized auto-motives to provide water and sanitation facilities to peri-urban communities in a pay as you use basis and have digesters for efficient disposal.

Aharikundira et al. (2015) in their study on sustainability of water services delivery in Urban Poor Settlements revealed that water supply trends in the past, present and future projections are very necessary for sustainable management. Current technological advancements were identified as key in enhancing water supply operations. Similarly, Lencha (2012) studied rural water supply management and sustainability in Ethiopia, Adama area and concluded that technical know-how and development are important in critical to achieve sustainability within systems. In rural water supply projects, sustainability is dependent on community ownership and management. The communities take the final decision on important aspects of the planning and implementation of water supply schemes. Good leadership play crucial roles in community based projects. This requires a firm foundation on trust and good working relationships with all stakeholders. There is need for time, resources and authority to invest in a water supply project. Flexibility is critical in the way project leaders implement project the activities the projects undertake.

Figure 1. Conceptual Framework
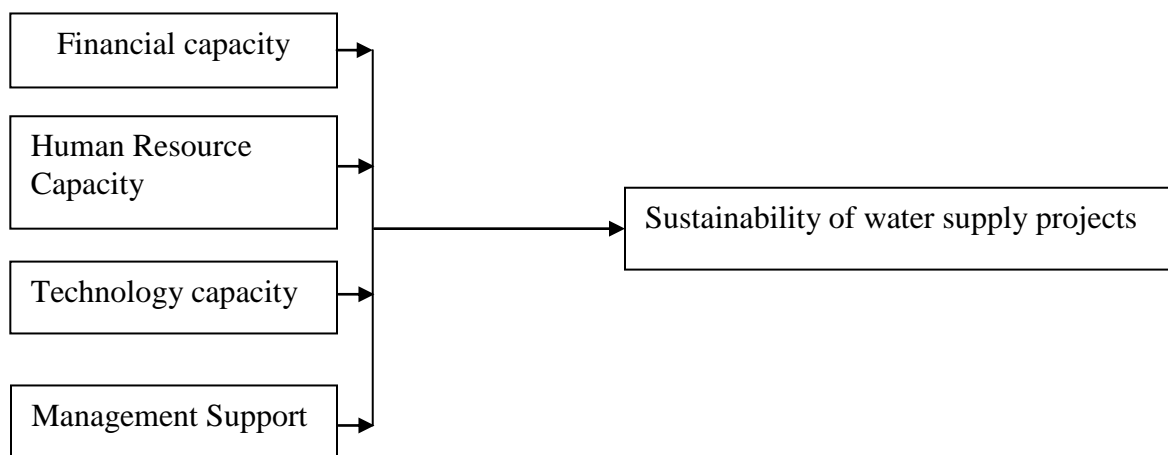
Critique of existing literature relevant to the study

Once all bottlenecks or constraints are identified and ranked, the organization must put in place measures to manage them. However, it is not all organizations that have the capacity to put in place a constraint management system or are able to change their strategies regularly. This affects sustainability of water supply projects. Operations and maintenance costs have been found to account for up to 95 % of the expenses water companies incur leading to unsustainable cost management. Profit water organizations experience poor financial performance because most of the revenues earned go to staff remuneration, operations and maintenance of the water plant and equipment.

The recommendation to put in place effective management systems for financial sustainability does not provide a systematic criteria or procedure to follow. The procedure should at least indicate which areas need a more critical analysis and effort to reduce costs and enhance sustainability of the water supply projects. Further, development of human resources is a daily affair of the water supply organizations. Moreover, the productivity per staff in water organizations is an important aspect in establishing performance of such companies. Earlier studies have not emphasized the importance of continuous improvement through capacity building and training of their employees. The companies should employ adequate numbers of new staff to ensure continuity just in case of staff turnover. Focusing only in developing skills of existing employees rather than hire more employees or conduct succession planning may in the long run prove counterproductive. This is because staff turnover can happen at any time due to various reasons.

Research Gaps

Previous studies on challenges facing sustainability of water service providers in supplying water to peri-urban regions have dwelt on project failure or success. The researchers appreciate the effect of climate change to management of water resources. While previous studies concentrated on investment on water infrastructure based on climate change and risks involved, they omitted the subject of challenges that face the ever increasing peri-urban population and their water needs. Very few have looked at the critical factors or determinants for sustainable management of water supplying companies. Existing literature further reveals gaps in understanding the relationship between capital investment and running of the water companies, especially in achieving both the rural communities and the national development goals in the water sector. The challenges of sanitation, waste management and hygiene sustainability in peri-urban areas have also been minimally handled in Kenya.

METHODOLOGY

According to Kombo et al. (2002), research design is the scheme; outline or plan that is used to generate answers to research problems. The study adopted descriptive survey design. This research design was preferred because it permitted the collection of data quickly, efficiently and accurately through questionnaires administered to a sample (Kothari, 2004, Mugenda & Mugenda, 2003,Oso&Onen, 2005).The data collected by this design was used to suggest reasons for particular relationships between independent and dependent variables (Saunders & Thorn Hill, 2007).Population according is the universe of interest or the total number of subjects or the total environment of interest to the researcher(Castillo, 2009, Kothari, 2013). The study

targeted all the 76 employees working in the water projects within Nyahururu Sub-county. The sampling frame must be so large to allow a researcher to feel confident about the sample representativeness and allow inferences to be made for the entire population (Silverman 2005). The sample frame for this study constituted all the 76 employees.

Table 1: Sampling Frame

Categories	Total Population	Percentage %
Management	10	13
Middle Level Employees	20	26
Support Staff	46	61
Total	76	100

Source: Nyahururu Water Company Staffing Section (2015)

A sample size of 64 respondents was randomly selected from the target population using the mathematical approach developed by Miller and Brewer (2003): $n=N/ [1+N (α)^2]$

Where, **n** is the Sample size, **N** is the Sampling frame (104), **α** is the Error margin (5%) and **1** is the Constant . $n=76/ [1+76 (0.05)^2]$ **n = 63.87   n = 64**

The study employed stratified random sampling method to draw respondents from the target population. A simple proportional formula (P x n/N); where P is the population, was used to select the respondents per strata for the interviews and questionnaire administration. Bryman and Bell (2007) have pointed out that stratified sampling "ensures that the resulting sample was distributed in the same way as the population in terms of the stratifying criterion". It also gives possibilities to use and make more than just one stratifying criterion.

Table 2: Sample Distribution

Categories	Total Population (N)	Sample (n)
Management	10	8
Middle Level Employees	20	17
Support Staff	46	39
Total	**76**	**64**

A self-designed semi-structured questionnaire was used to collect data from the respondents. Questionnaires are research instruments used to collect information geared towards addressing specific objectives (Kombo et al., 2002). The questionnaire items were scaled on a 5 point Likert scale. Data collection is the process of gathering specific information aimed at proving or refuting some facts. A pilot test was conducted in Nakuru Water and Sewerage Company (NAWASCO) to test validity and reliability of the research instrument. Validity test measures the

ability of the research instruments to measure what it is intended to measure(Kothari, 2004). A content validity test was conducted to ensure all indicators measured were adequately represented. According to Sukaran (2010), content validity is a function of how well the dimensions or elements of a concept have been captured. Reliability is the ability of research instruments to give consistent results over and over again.

Mugenda&Mugenda, (2003) recommends a 10% of the target population to be considered as a sample size in a pilot study. Validity was enhanced through appraisal of the research tools and verification through a pre-test to detect deficiencies and incorporating the comments and suggestions. A correlation coefficient greater or equal to 0.7 is acceptable (George &Mallery, 2003). Data analysis refers to examining what has been collected in a survey or experiment and making deductions and inferences (Kombo et al., 2002,Savenye&Robinson, 2004). The data collected was edited, collated to eliminate errors and coded for analysis using the Statistical Package for Social Sciences version 20 tool. The data was analyzed both quantitatively and qualitatively. Inferential analyses (correlation, ANOVA and regression) were generated to test the statistical significance of the effect of the independent variables on sustainability of the water supply projects.

$$Y= \beta_0+ \beta_1X_1+\beta_2X_2+ \beta_3X_3 + \beta_4X_4+\varepsilon$$

Where: Y= Sustainability of the water supply projects, β_0 is the regression coefficient/constant/Y-intercept, $\beta_1, \beta_2, \beta_3$ and β_4 are the coefficients of the linear regression equation. X_1 = Financial capacity, X_2 = Human resource capacity, X_3= Technological capacity, X_4= Management Support and ε = error term normally distributed about a mean of 0.

In this study internal consistency reliability test was conducted using Cronbach alpha test as depicted in Table 3.3 below. According to Malhorta (2004), the standard minimum value is α =0.7. Thus, the values of financial capacity α = 0.763, human resource capacity α = 0.756, technology capacity α =0.781 and management support α = 0.776. The results were a sufficient confirmation of data reliability for the four independent variables.

Table 3: Reliability Test Results

Variable	Cronbach Alpha	Number of Items
Financial Capacity	0.763	7
Human Resource Capacity	0.756	8
Technological Capacity	0.781	10
Management Support	0.776	10

FINDINGS AND DISCUSSIONS

A total of 64 questionnaires were administered and 60 were received as complete and well filled. This translated to a 93.8% percent response rate. This response was considered very appropriate in line with Sekaran (2008) who reported that any response rate above 75% is classified as best.

Table 4: Gender of the Respondents

Gender	Frequency	Percentage (%)
Male	35	58.3
Female	25	41.7
Total	60	100

The results in Table 4 shows majority of the respondents (58.3%) were male while (41.7%) were female.

Table 5: Job Categories of the Respondents

Job Category	Frequency	Percentage (%)
Managers	12	20
Middle level Employees	48	80
Total	60	100

There was participation of both the managerial and middle level employees in this study. The results in Table 5 indicated that (20.0%) of the respondents were managers while middle level employees were (80.0%).

Table 6: Level of Education of Respondents

Level	Frequency	Percentage (%)
Secondary	15	25
College	33	55
University	12	20
Total	60	100

On the level of education (Table 6), majority (55%) attained at least college level of education while (20%) attained degree level of education. 25% possessed secondary level of education. The profile of the respondents made a good sample as well educated respondents have the ability to furnish the study with better information value.

The number of years each respondent had worked with the water supply companies was also sought. Findings in Table 7 show that majority (45%) of the respondents had a working

experience of more than 5 years and 15% had worked 3-4 years. This meant respondents had adequate working experience in the water supply industry. Hence, they possessed the necessary knowledge and information which was considered useful for this study.

Table 7: Respondents' Years of Service

No. of years	Frequency	Percentage (%)
Less than one year	9	15
1-2 years	15	25
3-4 years	9	15
5 and above years	27	45
Total	60	100

Table 8: Years of Service in Current Position

No. of years	Frequency	Percentage (%)
Less than one year	9	15
1-2 years	15	25
3-4 years	18	30
5 and above years	18	30
Total	60	100

The study further examined the number of years each respondent had worked in their current position. Findings in Table 8show that majority (30%) of the respondents had served for more than 5 years in their current position while 30% had worked for 3-4 years. This means that majority of the respondents had adequate working experience in their positions.

Table 9: Descriptive Analysis of Financial Capacity Influence

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Company considers finance as one of the most critical resources	40.0%	25.0%	20.0%	10.0%	5.0%	100.0%
Company has adequate funds to maintain its water distribution infrastructure	5.0%	15%.0	45.0%	30.0%	5.0%	100.0%
Company has adequate funds to rehabilitate existing infrastructure	0.0%	15.0%	40.0%	30.0%	15.0%	100.0%
Company has adequate funds to compensate employees	20.0%	25.0%	20.0%	25.0%	10.0%	100.0%
Company has adequate funds to comply to all quality requirements	25.0 %	30.0%	30.0%	10.0%	5.0%	100.0%
Company has adequate funds to meet growing needs	0.0%	20.0%	25.0%	50.0%	5.0%	100.0%
Company has adequate funds to adopt to technological advances	5.0%	15.0%	50.0%	25.0%	5.0%	100.0%

Table 9 shows that majority of the respondents considered financial capacity as one of the critical resources on water supply project sustainability (40% strongly agreed and 25% agreed respectively). Therefore, water supply companies should enhance their financial capacities for sustenance of their operations. On maintaining water distribution infrastructure, majority of the respondents were either neutral (45%) or disagreed (30%) in that order. The responses on rehabilitation of existing infrastructure gave similar results. On employee compensation, majority of the respondents were not quite in agreement as more than half (55%) were neutral, disagreed or strongly disagreed. In meeting growing needs for water supply, 50% of the respondents disagreed. The findings on technological advancement revealed that 50% were neutral while 25% disagreed. These findings imply that the water supply companies should invest more funds on water maintenance, rehabilitation of existing infrastructure, compensation of employees and technology advancement. Further, majority of the respondents suggested borrowing investment funds, starting water bottling project, donor funding/grants, increasing water tariffs, cutting down expenses and streamlining employees as the financial options water supply projects could pursue.

Table 10: Descriptive Analysis of Human Resource Capacity

	Statement	Mean	Std. Dev
i.	Company considers human resource as an important resource	4.12	.892
ii.	Company has access to qualified employees	2.59	1.02
iii.	Company attracts qualified employees	2.56	.911
iv.	Company invests on staff training and development	2.72	.989
v.	Company empowers employees through provision of appropriate technological tools	2.85	.819
vi.	Company has adequate human resource capacity	2.49	1.016
vii.	Company uses modern technology to manage human resources	2.47	1.121
viii.	Company uses appropriate strategies to retain employees	2.63	.921

Human resource capacity is very important (mean of 4.12) as shown in Table 10. Upon further probing, majority agreed that the water supply companies had access to qualified employees(means 2.59). Further, the respondents were asked whether the company invests in staff training and a majority were in agreement (mean 2.72). Over half of the respondents agreed that the company empowers employees with provision of technological tools. The respondents were requested to respond to the opinion that the company had adequate human resource capacity and a majority disagreed (mean 2.49). In addition, a question sought to establish whether the company used modern technology to manage human resources and

majority disagreed with the view (mean 2.47, Std. deviation 1.121). On the same note, respondents were asked if the company used appropriate technology to retain employees and a majority were in agreement (mean 2.63 and Std. deviation .921).Moreover, majority of the respondents reported that improving working environment, enhancing trainings and motivation, recruitment of professionals, benchmarking, technology adoption, collection and documentation of operation procedures were the critical factors to ensure continued sustainability of the peri-urban water supply projects in Nyahururu sub-county.

The findings in Table 11 indicates that majority of the respondents agreed that the company considered technology as one of the most critical resources (mean 3.81). However, on accessibility to modern technology, the response was below average (mean 2.43). This implies that although modern technology is available, the company had limited access probably due to resource constraints among other factors. On adoption of latest technology as it emerges, majority of the respondents were not in agreement (mean 2.26). Responses on use of modern technology to monitor flow of water and management of customer information were below average (mean of 2.49 and 2.44). In addition, responses on use of technology to receive payments were above average (mean 2.58).The findings on use of modern technology to respond to customer concerns and problems, majority of the respondents rated their responses below average (mean 2.19).

Table 11: Descriptive Analysis of Technological Capacity

		Mean	Std. Dev
i.	Company considers technology as one of the most critical resources	3.81	.870
ii.	Company has access to modern technology	2.43	1.055
iii.	Company keeps adopting latest technology as they emerge	2.26	1.210
iv.	Company uses modern technology to monitor flow of water	2.49	1.222
v.	Company uses modern technology to manage customer information	2.44	1.04
vi.	Company uses modern technology to receive payments from customers	2.58	0.996
vii.	Company uses modern technology to respond to customer concerns and problems	2.19	1.162
viii.	Company uses modern technology to enhance prediction of market trends and planning	2.27	1.164
ix.	Company uses modern technology to manage disruptions in water supply when they occur	2.45	1.32
x.	Company uses modern technology to manage human resource information	2.52	1.246

On use of technology to enhance prediction of market trends and planning, the findings clearly indicated that it was below par (mean 2.27). Most of the areas like accessibility, monitoring water flows, managing water disruptions and prediction of market trends should be enhanced for quality and sustainable service delivery.

Table 12: Descriptive Analysis of Management Support

		Mean	Std. Dev
i.	Company incurs costs in acquiring and maintaining appropriate infrastructure	4.21	.721
ii.	Company incurs costs in distribution and supply of water	3.72	.730
iii.	Company incurs costs in human resource	4.12	.893
iv.	Company takes shortest time to connect water to applicants and handles customer complains	2.46	1.102
v.	Company maximizes the use of its current capacity	2.53	1.037
vi.	Company achieves continuous improvement in its services	2.45	1.054
vii.	Customers are satisfied that their interests are taken care of in company products and operations	3.02	.781
viii.	Customers get true timely and adequate information about the company services	2.50	1.132
ix.	Company is faced with minimal government regulation issues	3.43	.916
x.	Company is faced with minimum complaints on environmental management issues	3.01	1.100

In the Table 12 on management support, majority of the respondents were in agreement (mean 4.21) that the company incurs costs in acquiring and maintaining appropriate infrastructure. Similarly, majority (mean 3.72) agreed that the company incurred costs to distribute and supply water and on human resources (mean 4.12). Budgeting sufficient funding for rural water supply systems enhances sustainability and proper maintenance. On the other hand, majority of the respondents did not agree that the company takes shortest time to connect applicants and handle customer complaints. The findings revealed that customer complaints and connecting new clients to piped water was unsatisfactory. Maximum use of the current water connections was above average (mean 2.53 and Standard deviation 1.037). On continuous improvement of services, majority of the respondents did not agree with the view (mean 2.45).Further, the study sought to find the responses on customers' satisfaction and whether their interests were taken care of in company products and operations. Majority of the respondents (mean 3.02) agreed that their interests were met. Moreover, the study wanted to find out whether customers get true timely and adequate information about the company services. The response was indifferent (mean 2.50).

Table 13: Descriptive Analysis of Sustainability

		Mean	Std. Dev
i.	Company often ensures there is functioning and complete water system	3.25	.821
ii.	Company help maintain water system and supply in peri-urban areas	3.18	.913
iii.	Company offers training on sanitation, hygiene and use of water regularly	2.48	.795
iv.	Monthly fees collected from households are enough to pay for operation and maintenance of water systems	2.39	1.123
v.	Monthly cost of water charged on the households is sustainable and manageable	2.36	1.213

The findings in Table 13 imply that the company is obliged to maintain functioning water systems in order to remain in business (mean 3.25). It was also found that the company helps in maintaining water system and supply in urban areas. On sanitation, hygiene and use of water training, the study established that the company should enhance employee trainings (mean 2.48). In addition, monthly fees collected from households were insufficient (mean 2.39) to cater for operation and maintenance of water systems. Monthly cost of water on the households was not sustainable (mean 2.36). The company should prioritize employee training and diversify revenue sources. They should also sensitize communities; enhance customer loyalty and information sharing. High initial costs, vandalism, corruption and misuse of resources were cited as the main challenges affecting sustainability. Other obstacles identified were rural-urban migration, lack of cooperation among people, availability of cheap water from streams and lack of community initiatives.

Table 14: Correlation Analysis between Financial Capacity and Sustainability

		Influence of Financial Capacity
Sustainability of peri-urban water projects	Pearson Correlation	.759[**]
	Sig. (2-tailed)	.000
	N	60

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

Findings in Table 14 shows a strong positive correlation between financial capacity and sustainability of peri-urban water supply projects(r = 0.759). Based on the decision rule for significance level, we accept the alternative hypothesis and conclude that that financial capacity influences sustainability of peri-urban water supply projects. The findings are consistent with those of Angel (2009) who reported that in water providing organizations, financial resources are required for new infrastructure, rehabilitation and maintenance of service quality over time.

Also, Binder, (2008) found out that community management of rural water supply systems on operation and maintenance is not successful, if financing resources are not available and frequent support is not provided.

Table 15: Correlation Analysis between Human Resources Capacity and Sustainability

		Influence of human resource capacity
Sustainability of peri-urban water projects	Pearson Correlation	.754*
	Sig. (2-tailed)	.037
	N	60

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

There was a strong positive correlation between human resource capacity and sustainability of peri-urban water supply projects (r = 0.754). Based on the decision rule for significance level, we accept the alternative hypothesis and conclude that human resource capacity influences sustainability of peri-urban water supply projects. These findings complements those of Onsomu et al. (2013) who argued that the productivity per staff in water organizations is an important aspect in establishing performance and efficiency of such companies.

Table 16: Correlation Analysis between Technological Capacity and sustainability

		Influence of technological capacity
Sustainability of peri-urban water projects	Pearson Correlation	.769*
	Sig. (2-tailed)	.041
	N	60

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

The study found the existence of a strong positive relationship between technological capacity and sustainability of peri-urban water supply projects (r=0.769). Based on the decision rule for significance level, we accept the alternative hypothesis and conclude that technological capacity influences sustainability of peri-urban water supply projects. The findings are consistent with Lencha (2013) who reported that technical know-how and development are key in critical water supply operations.

Table 17: Correlation Analysis between Management Support and sustainability

		Influence of management support
Sustainability of peri-urban water projects	Pearson Correlation	.770*
	Sig. (2-tailed)	.048
	N	60

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

The findings in Table 17 indicate that there exist a strong positive relationship (r=0.770). Based on the decision rule for significant levels, we accept the alternative hypothesis and conclude that management support influences sustainability of peri-urban water supply projects. The findings are consistent with Niyi et al., (2007) who reported that budgeting sufficient funding for rural water supply systems is an important issue for sustainability and proper maintenance.

Table 18. Regression Model Summary

Model 1	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0.7654(a)	0.586	0.530	0.3868

a) Predictors: (Constant), Financial capacity, Human resource capacity, Technological capacity and Management support.

A multiple regression analysis was conducted and the coefficients show the relationship between the independent and dependent variables. The findings revealed that the four independent variables explained only 58.6% of the sustainability of peri-urban water supply projects. The findings imply that other factors (41.4%) should be subjected for further research or analysis.

Table 19: ANOVA (b) Sustainability of peri-urban water supply projects

Model 1	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1.6764	3	0.5588	2.7034	.0221
Residual	11.5768	56	0.2067		
Total	13.2532	59			

b) Dependent Variable: Sustainability of peri-urban water supply projects

The ANOVA analysis indicated that the overall variance accounted for in the model had an $F_{(3, 56)}$ = 2.7034, $p < 0.05$, $\alpha = 0.05$. Since the P value 0.0221 is less than 0.05, the relationship between the predictor variables and dependent variable is statistically significant indicating the existence of a regression relationship. We therefore conclude that capacities in financial, human resource; technology and management support influence the sustainability of peri-urban water supply projects.

Table 20: Regression Coefficients

Model	Un-standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.1207	1.140		1.390	.297
Financial Capacity	0.6527	0.2709	0.148	2.017	.0242
Human Resource Capacity	0.6122	0.2718	0.142	3.069	.0311
Technological Capacity	0.6870	0.3037	0.138	3.018	.0191
Management Support	0.6425	0.2780	0.140	3.057	.0220

In Table 20, the results of the multiple regression analysis are illustrated.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

$$Y = 1.1207 + 0.6527 X_1 + 0.6122 X_2 + 0.6870 X_3 + 0.6425 X_4$$

The findings in Table 20 show that holding all the four variables at zero, the constant is 1.1207. Further, analysis shows that taking all other independent variables at zero, a unit increase in financial capacity leads to a 0.6527 increase in the sustainability, a unit increase in human resource capacity will lead to a 0.6122 increase in sustainability, a unit increase in technological capacity leads to a 0.6870 increase insustainability, a unit increase in management support will lead to a 0.6425 increase in sustainability of the peri-urban water supply projects respectively.

SUMMARY OF FINDINGS

From the study findings, the response rate was 93.8%. 58.3% were male while 41.7% were female. 20.0% of the respondents were managers while middle level employees were (80.0%) and 55% attained at least college level of education. 20% had degree level of education. Majority (30%) of the respondents had served for more than 5 years in their current position while 30% had worked for 3-4 years. In terms of working experience, majority (45%) of the respondents had a working experience of more than 5 years.

Assessment of Financial Capacity

Financial capacity greatly impacts peri-urban water supply projects as it was considered as one of the critical resources on water supply project sustainability. Enhancing financial capacities enables water supply companies to handle both sustenance and operations. However, the findings also established that water distribution infrastructure were not adequately maintained nor rehabilitated. Resource constraints or limited financial resources were reported by majority of the respondents as being inhibitive. Solutions lie in increasing the budget allocation for rural water supply systems. Employee compensation should also be enhanced as well as adherence

to compliance to quality requirements. It is also apparent that the water supply projects did not meet growing needs for water supply due to inadequate capacity. This was compounded by slow technological adoption, limited access to resources and investments for maintenance, rehabilitation of existing infrastructure, compensation of employees and technology advancement. In comparison with similar studies, financial factors again emerged as a major determinant of performance in water supply companies. The water supply companies should explore opportunities to consider various funding mechanisms. Borrowing investment funds, starting water bottling project, donor funding/grants, increasing water tariffs and cutting down expenses were highlighted as opportunities to raise funds.

Assessment of Human Resource Capacity

Human resource capacity is very critical in peri-urban water supply projects. From findings, peri-urban water supply projects have access and attraction to qualified employees and invest in staff training. The water supply projects empowered the employees and provided them with technological tools. However, there was a gap on adequacy of human resource capacity to use of modern technology though the companies used appropriate technology to retain employees. On employee succession planning to ensure continued delivery of quality water and services to surrounding communities, majority of the respondents suggested that improving working environment, enhancing trainings and motivation, recruitment of professionals, benchmarking, technology adoption, collection and documentation of operation procedures must be emphasized. Earlier researches recommend that development of human resources is a daily affair of the organization. Productivity per staff in water organizations is also an important aspect in establishing performance of such companies.

Assessment of Technological Capacity

From the findings, technology is one of the most critical resources for sustainable peri-urban water supply. However, accessibility to modern technology was limited due to resource constraints and therefore, this affects adoption of the latest technology as it emerges. The use of modern technology to monitor flow of water and management of customer information was very minimal. In addition, the water supply projects employed modern money transfer technologies to receive payments. The findings on use of modern technology to respond to customer concerns and problems yielded a negative feedback. Similarly, on use of technology to enhance prediction of market trends and planning, the findings clearly indicated that it was below par. Technology use to manage water disruptions whenever they occurred was very limited. The findings imply that there are critical issues facing adoption of modern technologies

by Water Company. Accessibility, monitoring water flows, managing water disruptions and prediction of market trends should be enhanced for quality and sustainable service delivery to peri-urban areas.

Assessment of Management Support

The water supply company incurs costs in acquiring and maintaining appropriate infrastructure. Therefore, the management should budget for sufficient funding of peri-urban water supply systems to foster sustainability and proper maintenance of water infrastructure. Further, the findings revealed that customer complaints and connecting new clients to water was not done on time. This negatively affected maximum use of the current water connections and continuous improvement of water supply services. In addition, customers did not get true timely and adequate information about the company services. However on the other hand, most customers were satisfied that their interests were taken care of by the company products and operations. Moreover, the company faced minimal government regulatory and environmental management issues.

CONCLUSIONS

This study concluded that the peri-urban water supply projects should seek to implement technology in their operations. More investment funds should be put in water maintenance, rehabilitation of existing infrastructure, compensation of employees and technology advancement. This will go a long way in meeting the growing water needs in the peri-urban areas of Nyahururu sub-county. The financial capacities of the peri-urban water supply projects should be enhanced by exploring various financial opportunities to fund their operations. Further, the water supply companies should invest in staff training and empower them with technological tools. The water supply companies should improve on employee succession planning for continued delivery of quality water and services. Accessibility to technology, monitoring water flows, managing water disruptions and prediction of market trends should be prioritized. This will help in handling customer complaints especially connecting new clients to water on time. Continuous improvement of water supply services should be a daily endeavor to realize sustainability and timely feedback to customers.

LIMITATIONS OF THE STUDY AND FURTHER STUDIES

This study assessed only four variables (Financial capacity, human resource capacity, technological capacity and management support) and their influence on sustainability of water supply projects in Nyahururu Sub-County. Further, the respondents were a bit reluctant to

provide relevant information at the beginning for fear of being exposed or investigated by the management. This was overcome by assurance and explanation that the data was confidential and for academic research purpose only.

The study recommends further research on effects of technology adoption in handling customer complains in peri-urban water supply projects. Moreover, the study also recommends research on the influence of continuous improvement on delivery of peri-urban water supply projects in Kenya.

RECOMMENDATIONS

This study recommends that peri-urban water supply projects should budget for technology adoption and implementation to improve their services and operations. Further, more investment funds should be put in water maintenance, rehabilitation of existing infrastructure and compensation of employees. The peri-urban water supply projects should endeavor to broaden their financial capacity by evaluating their water tariffs. In addition, the water supply projects should consider venturing into new investment frontiers like water bottling to raise more capital. Further, the water supply companies must invest in staff training, empowerment and integrate technology adoption for efficiency. Employee succession planning for continued delivery of quality water and services must be planned in advance and regularly. Handling customer complaints and continuous improvement of water supply services should be a daily endeavor to realize sustainability.

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