

**PUBLIC PRIVATE PARTNERSHIP ON SUSTAINABILITY OF WATER
SUPPLY PROJECTS: A CASE OF KIWASCO, KISUMU COUNTY, KENYA**

BY

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DECLARATION

This research project report is my original work and has not been presented for the award of a degree in this or any other university.

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DEDICATION

This project is dedicated to my Mother Alice Mariwa for her unrelenting support to me in my education since childhood up to now. I also dedicate this work to my Wife Diana for her unwavering support and understanding. To my sons Ken and Emmanuel, my daughter Favor Ruth, you gave me during the time I was carrying out this research.

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ABBREVIATIONS AND ACRONYMS

ADB:	African Development Bank
AFD:	French Agency for Development
CBO:	Community Based Organization
EU:	European Union
IWSP:	Independent Small Water Service Provider
KIWASCO:	Kisumu Water and Sanitation Company
LA:	Local Authority
MDG:	Millennium Development Goal
MSF:	Multi Sectorial Forum
NMISWR:	National Monitoring and Information System on Water Resources
NWC&PC:	National Water Conservation & Pipeline Corporation
NWRMS:	National Water Resources Management Strategies
PPP:	Public Private Partnerships
SANA:	Sustainable Aid in Africa International
SIDA:	Swedish International Development Agency
WAB:	Water Appeal Board
WRMA:	Water Resources Management Authority
WRUA:	Water Resources Users Association
WSB:	Water Services Board
WSP:	Water Services Provider
WSRB:	Water Services Regulatory Body

ABSTRACT

Public- Private Partnership in water projects is geared towards sustainability in the water supply programs. In Kisumu, Kisumu Water and Sewerage Company (KIWASCO) has been the main Public private partnership on sustainability of water supply projects in the region. KIWASCO was established through the reforms that took place in the water sector nationally and based on the decision to privatize essential services. The purpose of the study was to establish the influence of public private partnership on sustainability of water supply projects: a case study of (Kisumu Water and Sewerage Company) KIWASCO in Kisumu, Kenya. The study was guided by the following research objectives: funding, technology and innovation, risks involved and economic diversification and how they influence sustainability of water supply project in KIWASCO. The research design used was descriptive survey. The study targeted a sample of 382 KIWASCO water users and 10 KIWASCO officials in all managerial positions. The data collection instruments included a questionnaire and an interview guide. Data analysis was descriptive in the form of frequencies and percentage. From the study findings, data collection was regular with data analysis carried mainly through software. Descriptive tables were used to display distribution of population in relation to demographic factors. Descriptive statistics (that is frequency analysis) was computed for presenting and analyzing the data. This ensured efficiency and effective data presentation. The study found out that project financial auditing affected sustainability of water supply to a great extent. Project financial utilization affected sustainability of water supply to a great extent. Adequacy of project equipment affected sustainability of water supply to a great extent. Reliable water connectivity affected sustainability of water supply to a great extent. Elaborate risk management plan affected sustainability of water supply to a great extent. Increased farming activities and self-sustenance affected sustainability of water supply to a great extent. Creation of employment affected sustainability of water supply to a great extent. The study concluded that project financial auditing, financial utilization and budget reliability affected sustainability of water supply to a great extent. The study revealed that adequate equipment, reliable water connectivity and quality of water affected sustainability of water supply to a great extent. Elaborate risk management plan prevents hazards from happening in advance. Risk preparedness helps KIWASCO in getting ready for inevitable hazards for instance natural drought and famine. Risk communication and sharing helps KIWASCO in dividing its risks and losses with both private and public partners. Reduced water prices has led to increased savings and investments. The study recommends that KIWASCO should be scrutinized and audited by external auditors annually. The pumps should be durable to avoid breakage. Water treatment plants need to be implemented and be well maintained to avoid hazardous water supply. There is need to adopt risk mitigation and assessment to prevent hazards from happening in advance.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

A Public Private Partnership (PPP) arrangement refers to cooperation between the public and private sectors in providing public goods and services. According to Tochitskaya (2007), the functioning principles of private enterprise are incorporated in public administration with a view to improving the quality and efficiency of public service delivery. Recent political and economic crises in the public sector in post Structural Adjustment Programme period, have led to the realization that neither the state nor the private sector alone can spur economic growth and development (Schroth, 2008). There is consequently an emerging tendency to set up Public-Private Partnerships as a way of fulfilling public tasks.

Water supply is managed differently in various developed countries, with various results. In Europe, apart from France and the United Kingdom, water is predominantly publicly supplied. In France, the private sector provides water to 75 percent of the population, in the U.K. 86 percent, and in Spain 27 percent (Hall, 2007).

Globally, in France, municipalities are in charge of water supply and they award concessions or contracts to private companies, whereas in the U.K., water companies own state-allocated regional firms and each company operates only in a particular region (Sommers, 2011). When seeking to involve the private-sector in water and sanitation infrastructure projects, a host country's legal framework is considered (Budds, 2002). Regulation of the sector (including regulation of tariffs, performance and standards) is important for all service delivery, whether provided by the private or public sector. Regulation of tariffs and regulatory risk that this carries are effective to PPPs in the water sector (McGranahan, 2003). This documents provides a framework for water companies as they consider negotiating bulk supply agreements with other appointees. A bulk supply is a supply of water from one appointed company to another. Bulk supplies are sometimes referred to as 'water trades' as they are a way for water companies to trade

water (Schneider, 2004). Transporting the bulk supply from one company to another company involves an 'interconnection', often in the form of a pipe. Companies can draw up a contract between them (a 'bulk supply agreement') that sets out the terms and conditions of a bulk supply, including the price. This guidance is to encourage trading between appointed water companies and promote competition. Three major groups in France operate almost all the privatized water utilities through local subsidiaries; Suez, Veolia (formerly part of Vivendi) and Saur (Belay, 2007).

In France and Spain, however, an alternative way of involving private companies in water operations, different from outright privatization, had been emerging over more than a century. The concept was that of a partnership with shared responsibilities, in which local governments delegated the management of a water utility to a private operator while retaining the assets as public property (Triche, 2000). Various contractual forms evolved, with differing levels of responsibility and risk for the private partner, ranging from concessions to management contracts. In France, the most original concept was the affermage (a newly established private utility operates a publicly owned system and collects revenues that it then shares with the public owner, who remains in charge of investment), whereas in Spain, (mixed-ownership companies) emerged (Marin, 2009).

Some of the successes of PPP in water supply project in France include earlier delivery of a planned capital investment programme, as PPPs provided an important additional funding to complement traditional budgetary envelopes. Efficiency gains in project implementation by completing individual projects faster was also a great gain in the PPP in France. Better maintenance and improved service levels than traditional projects through a whole life approach is a major success in water supply projects in France under the PPP arrangement.

However, this did not go without limitations like PPPs having not protected the public partner from over-optimism regarding future demand and use of the planned infrastructure. The PPP option was also chosen without any prior comparative analysis, to demonstrate that it was the one maximizing value-for-money hence the challenge in determining the true value for money in the water services provided in France.

On the other hand, Italy continues to pursue industry consolidation and to increase private sector participation in water supply sustainability. A law was indeed passed in September 2004 preventing any privately owned company from providing drinking water services to the public without government intervention (Hall et al., 2005). For instance, the annual turnover of the water service industry in 2009 was about €6.5 billion, for about 5.5 billion cubic meters of water distributed, while according to some estimates, the water service supply industry will need about €65 billion of investment in the next thirty years, most of which will be needed to keep the operating infrastructure efficient. The infrastructure obsolescence and the scarce amount of network recovery work done in the past mean that the public sector has to allocate in the future budgeting plans a great amount of financial resources to deal with unplanned maintenance of the water service supply assets (Todaro, 2012). It is clear that, in this context in which the necessary investment is greater than the available public resources, and the regulatory framework is extremely articulated and still evolving, it is important to stimulate and support the entrance into the water service supply industry of private actors, adopting new participative models more oriented to competition and the market (Vidyarthi, 2006). In terms of production technology, the provision of drinking water is dependent on a distribution infrastructure, the construction and maintenance of which represent the major costs, and all relevant stages of the service value chain capitation, treatment, and distribution and waste water collection are supported by this infrastructure. In theory, all these activities can be performed by single operators according to the principle of unbundling. However, the possibility to exploit complementarities and scope economies urged the Italian legislator to adopt as the prevailing business model the integrated supply of all services related to water management (drinking water, waste collection and depuration, and sewerage) (Sankhe, 2010).

Enormous successes In Italy in PPP in water supply project included sharing risks with the private partner and optimizing costs throughout the life-time of the project. Combination of public and private expertise in the most effective manner ensured that the

partnership performed in-depth project assessment and ensured the achievement of optimization of the project scope.

Even though success can be counted in Italy, this did not go without limitations like inappropriate risk allocation, resulting in less incentive or excessive risk exposure for the private partner a case in which risk allocation was not coherent with the criteria for awarding the PPP contract and not coherent with private risk capital remuneration leading to excessive risks borne by the private partner.

Scarce and poor-quality municipal water is arguably one of the most pressing problems facing developing countries, including India, where only 64% of the population has access to individual water connections or to water stand posts¹ and water supply ranges from 1–six hours per day, with a per-capita supply of as little as 39l per day (HPEC, 2011). Pandering for votes, political actors at the state- and local-government levels have shown a marked proclivity either to not charge for water or to under-charge. This has led to a lack of funds for developing and maintaining water infrastructure, resulting in severe negative impacts that are mainly borne by low-income households the very constituency the under-charging purportedly benefits(Al-Hassan,2012)

Low-income households have to pay a disproportionately large proportion of their income for privately supplied water to secure reliable access that ought to be provided by civic entities, a phenomenon shared by several developing countries (Fuest and Haffner, 2007). Institutional dysfunction is also a factor. The fragmented administrative structures and low To meet India's water delivery challenges, experts have suggested a variety of approaches, such as decreasing the proportion of non-revenue water, covering 100% of expenses through user charges and the use of public-private partnerships (PPP) (HPEC, 2011)The PPP model for infrastructure delivery is often employed for one or more of the following reasons: a) to attract private investment for developing a project (capital funding); b) to benefit from private sector technical expertise; and c) to realize gains from private sector operational and management efficiencies. Furthermore, several central government programs and policies have stressed the need to encourage private-sector participation and to explore financially sustainable ways to develop urban infrastructure,

such as the Jawahar Lal Nehru National Urban Renewal Mission (Vidyarthi and Mathur, 2017). While the overall performance of such measures at the national level has been mixed, the potential signaled by the contagion effect of a few examples is noteworthy. For example, the PPP model for water supply employed by three cities in Karnataka—Belgaum, Gulbarga, and Hubli-Dharwad has encouraged water delivery reforms in other cities in Karnataka and in Nagpur, Maharashtra (Agrawal, 2005).

The reasons for privatization, and or public private partnerships have been different from one country to another (Mathur, 2014). In addition, privatization was launched mainly because of heavy political control of public utilities and alleged government corruption. At the end of the 2000s almost all Asian countries had some form of private sector participation in the water sector or were considering reforms to facilitate it. By the end of the 2000s, 14.8 percent of urban water consumers in Asia were served by some form of PPP (Foster, 2005).

Regionally, in Gambia, approximately half of the PPPs awarded either have been terminated early or have expired with a return to public management. It is also noteworthy that most of the cancelled PPPs in Africa were for combined power and water utilities, in which water was a secondary activity (Tatham and Houghton, 2011). The rate of active projects for combined water and power utilities is only about 20 percent, with half of the contracts having been terminated early, contrasting sharply with the rate for water-only PPPs, for which about 90 percent of the contracts are still active (Marin, 2009). The termination of contracts were seen in Chad, Comoros, The Gambia, Guinea-Bissau, Madagascar, Mali, Rwanda, and São Tomé and Príncipe.

Private water infrastructure projects in developing countries in Africa (Nigeria, Mali, Burkina Faso, and Uganda) increased in the 2001 with a peak in 2004, and have declined since 2006 (Selda and Emmett, 2010). The trends in developing countries show that water projects became smaller in 2001-2004 compared to 1995-2000 and involved more management contracts than concession or lease contracts. The average annual investment flows in water utilities decreased from US\$3.6 billion in 1995- 2000 to US\$1.1 billion, while the annual number of projects changed from 28 in 1995-2000 to 27 in 2001-2004

(Agrawal, 2005). The number of lease contracts fell from 19 in 1995-2000 to 9 in 2001-04, while management contracts increased from 10 to 18. Similarly, concessions declined in both number and size. By the end of 2007, there were more than 220 active water PPPs in 41 developing countries. Water PPP projects have been developing in different ways, depending on the country or region, responding to the specific features of reforms, country risks, and financial markets, and to the local political economy (Graeme, 2010).

Similarly, the Government of Kenya has warmed up to private sector participation on a large scale in this sector from 2003. It formed seven Water Service Boards (WSB), which in turn invited agents, known as Water Service Providers (WSPs) to provide water services with licenses from Water Services Regulatory Board (WSRB) (Salvage, 2007). The WSPs included former water departments of each local authority (LA) registered as public limited companies (PLCs), Community Water Cycles, Independent Water Service Providers and the National Water Conservation and Pipeline Corporation (NWCandPC) (Deelesgues, 2006).

Public Private Partnership as a strategy of public service management reform was acknowledged in the 1990s as crucial to sustainable development initiatives especially in the developing countries mostly in Kenya (World Development Report, 2013). The reform was at the time universally sanctioned as a means to bring about efficiency, effectiveness and value for money in the public sector which was recording development failures and disappointments as a result of, not only inappropriate policy choices, but also bureaucratic red tape leading to poor performance by state institutions (Kuriyan and Ray, 2009). The expansion of the public sector consequently ceased to be the automatic policy preference in most developing countries (Carsten, 2007). The water service in Kenya is one of the sectors that have undergone sectorial reform to accommodate Public-Private Partnership in the provision of water and sanitation services.

In Nairobi, The Kenya Water Act 2002 opened up to participation of the private sector, civil society, and communities in the management and development of water resources (Tysseland, 2009). A variety of water projects in both public and private sectors were therefore initiated and operated in various forms of partnerships with no proper

guidelines. Arising from the ambiguity of the policy, different types of private initiatives emerged in the water sector: Water Service Providers (WSPs), water service regulators, and water service provision financiers (Obosi, 2011). There was no defined order and extent of interactions but a multiplicity of choices in each of the water projects, whether public limited companies which involved private competence or community-based water projects which at times involved government capital to expand the quality and production of public goods and services (Wafula,2012).

In Kisumu city, fortunately, it has already taking a number of critical steps to make improvements in its water supply and sanitation systems. Several projects have been initiated in partnership with NGOs and foreign development agencies in conjunction with public partnership. Agence Française de Développement (AFD) has pledged a KShs 1.7 billion (€20 million) soft loan to improve water supply and sanitation services (Oloruntoba, 2006). The first phase of this project has been completed, leading to several improvements for the city; among them, an extension of the water network to the informal settlements, the construction of water kiosks and the rehabilitation of water treatment plants to meet their original design capacity. The second and final phase is longer-term; its objectives include building new intakes, new treatment plants and a new sewerage system (Omondi, 2013). The AFD has also sponsored some smaller projects, including an effort to form public-private partnerships, to increase water and sanitation coverage in the informal settlements of Nyalenda and Manyatta, where MCI is also concentrating significant effort. CORDAID, a Dutch NGO, has developed an “Urban Matters” program to address water and sanitation also in Manyatta, as well as other infrastructure challenges such as housing and urban transportation. This program revolves around a common action plan developed by both Dutch and Kisumu officials (Nyamu, 2010).

In Kisumu, Kisumu Water and Sewerage Company (KIWASCO) has been the main Public private partnership on sustainability of water supply projects in the region. KIWASCO was established through the reforms that took place in the water sector nationally and based on the decision to privatize essential services (Ombui,2012). The Company was established in July 2003 as an independent company after the

transformation of the water and sewerage department of the Kisumu Municipal Council. The core objective of KIWASCO is to make the water and sewerage services provision a commercial activity that generates sufficient revenue to sustain its operations throughout Kisumu County (KIWASCO, 2004). The target population of the KIWASCO and its main aim is to serve approximately 259,258 people in the Kisumu municipality (Kenya National Bureau of Statistics, 2009).

The sustainability of Public Private Partnerships in water supply can be assessed under the following; funding, technology and innovation, risk and economic diversification.

1.1.1 Public Private Partnership in the Water Supply

According to Bakker (2003), in the developed countries, for instance, United States Of America, commercialization refers to “a networking of the management institutions (rules, norms and customs) and entails the introduction of markets as allocation mechanism, market stimulating decision-making techniques and the displacement of Keynesian-welfare state principles in policymaking”. It is therefore a way of transacting business which may be introduced under public or private enterprise as an effect to this, it brings about economic diversification due to the employment of private partnership in public water supply development projects. Privatization is a political strategy which creates new rules and allocates rules among the state, the market and civil society even more specific. (Savas, 2007) is states that there are four types of privatization: ideological (less government), populist (more government), pragmatic (effective solutions), and commercial (more business). It is important to note that PPPs, irrespective of the form adopted, usually imply some form of reduction of state/public involvement in the management, ownership, and provision of public utilities and services by introducing privatization principles as discussed in the next section (Prasad, 2006).

Although different countries follow different modes in terms of degree of public and private sector involvement in the provision of public utilities, a common trend was observed across the range of country contexts examined (Mungatu, 2012). There in fact seems to be a general consensus among policy makers and experts that government should disengage from utilities sectors like electricity and telecommunications but not the

supply of water services. Water is seen as unavoidably social in nature and evokes political emotions like no other issue (Ahad, 2006).

In most African countries for instance Nigeria, the objectives of privatization are a limited welfare state, flexible labor market and restrictive fiscal policies which are given priority over those of traditional social policies (Prasad, 2006). This ensures Delivery of quality work cost effectively. It was hoped that private sector participation would bring in much needed investment, increase access and improve quality of water supply in the developing world in the same way it did to the developed world (Mohamed, 2012). By the end of the 2008, water supply systems in most cities of the developing world were facing growing problems of quality, reliability, and coverage. A vicious circle had developed: without maintenance, systems deteriorated, delivery became unreliable, and water quality worsened. Ill-served customers neglected to pay their water bills and resisted tariff increases, leaving even fewer resources to maintain the infrastructure (Marin, 2009).

Appropriate risk allocation between public and private sectors according to their risk management capabilities is crucial for the success of public-private partnership (PPP) projects as depicted in Ghana Water supply projects (Robinson, 2003). The Risk Allocation process in PPP water projects is examined, risk allocation analysis is outlined with Risk Allocation principles that can be used by public-private participants to arrive at fair RA decisions. The public evaluates risk factors are evaluated on each Risk allocation principle, analyzed and assigned between the public and private sectors. The results show that it is appropriate to allocate risks according to both sectors' capability to manage them, using established Risk Allocation principles (Moeiny andMokhlesi, 2011). The methodology renders the decision-making process more systematic and practical because the fuzzy theory approach allows decision makers to express their evaluations of both sectors' Risk Management capabilities in descriptive qualitative terms. In many projects across the globe the risk allocation should assist public clients to establish efficient RA strategies and develop balanced RA schemes for PPP contracts, with a view to achieving a mutually acceptable RA with the private sector (Infrastructure Consortium for Africa, 2004).

In Sub Saharan Africa countries, (Kenya, Uganda, Tanzania, and Congo) the performance of water and sanitation utility companies varies greatly, but many are underperforming (Steinert, 2012). This is due mainly to systemic issues, which can include weak governance, lack of accountability, poor management, inadequate or ageing infrastructure, and insufficient funds for operations and maintenance. These all adversely affect service delivery. For many people, having 24x7 access to a safe water connection at home is still a dream. To review potential options for improving water and sanitation services for people, governments often approach the World Bank Group as an objective, expert partner that can work with them to bring national, regional and international experiences to allow for customized solutions - solutions that will help move towards a goal of universal access, affordable to customers and which are sustainable (Kovacs, 2005). They also know that the World Bank Group will ensure the protection of people and the environment during development projects (World Bank, 2009).

The World Bank Group offers financial support and technical assistance to governments working to upgrade, repair, maintain or expand water and sanitation services (Howard, 2008). They mainly support countries looking to ensure efficient, transparent and sustainable delivery of water and sanitation services to citizens, including in underserved areas. The World Bank Water Global Practice oversees approximately \$25 billion in grants, low interest loans and technical assistance through 177 public sector projects focused on improving public sector services to citizens with the largest programs in water supply and sanitation followed by irrigation and water resources management (Hanne, 2009). The World Bank Group provided \$4.7 billion in grants, low interest loans and technical assistance to support governments' water, sanitation and flood protection projects (Marom, 2013).

In the construction of Athi Water supply in Kenya, the government employed private partnership in order to bring along their technological and innovation expertise (Juga, 2006). As a general matter, governments play a large role in the innovation process because scientific knowledge and technical know-how are public goods. If all knowledge is fully privatized (such as through patents), there will be an under-use of knowledge. By co-financing the research, development, demonstration and diffusion of new technologies

alongside business, governments spur economic progress and find solutions to challenges such as human-induced climate change. It is notable that most of the technological advances of recent decades, including space science, semiconductors, computer science, genomics, molecular biology, nanotechnology, the Internet, and more, were strongly backed by governments in the early stages of their development (Witters,2009).Privatization and other varieties of private sector participation in water services tend to be associated with neo-liberal reform strategies which emphasize the importance of market, fiscal discipline, trade, investment and financial liberalization, deregulation, decentralization, privatization and a reduced role for the state (Hewison, 2005).

The private sector involvement in the provision of water services has been controversial. It has attracted three different schools of thought (Prasad, 2006). First, there is the group dominated by major international financial institutions like the World Bank arguing that since the government has failed to provide access for everyone, it is worth turning to the private sector and market principles to solve the problem. The second group argues that water is a common good whose supply should not be in the hands of the private sector since it should never be treated as a commodity based on market principles being essence of life itself. This school of thought holds that access to water is a human right and it is the government's obligation to provide such a vital resource to everyone (Juntunen, 2007). The third group believes that better services could be realized by considering water as an economic good and a human right at the same time. It is the position of the third group that has given rise to the Public-Private Partnerships (PPP) in the supply of water by emphasizing both access and sustainability (Public-Private Infrastructure Advisory Facility, 2009).

In practical terms, it means that the supply of water should not be left to any one sector alone, but in a partnership in order to realize a synergy. Individuals, community groups, private firms and the state are therefore welcome to form partnerships to enhance provision of water services.

1.2 Statement of the Problem

Water vendors who supply piped water to informal settlements in Kisumu County typically charge rates that are 50 percent higher than rates provided by the water utility. As a result, many informal settlements residents rely on shallow well water, which is often contaminated because of a high density of pit latrines in the vicinity of the wells. Expanding the number of septic tanks could mitigate the negative impacts of pit latrines in informal settlements and composting toilets should be promoted in peri-urban areas. Challenges that face the entire city include quality water production to meet the demands of a growing population, employing new technology in water sector, improving revenue collection, reducing water loss, expanding solid waste collection, developing recycling activities, high cost of water and rehabilitating sewers. As a result KIWASCO as a product of public private partnership was established to meet improve water and sewerage sustainability. Through these challenges this project is geared towards researching on the influence of public private partnership on sustainability of water supply project as a case study of KIWASCO.

Public Private Partnerships describes a relationship in which public and private resources are blended to achieve a set of goals judged to be mutually beneficial to both the private entity and the public (Witters, Marom, and Steinert, 2012). A partnership between a public entity and private company is a strategy used to attain certain public sector needs and goals. It is a fairly new concept in Kenya since it was adopted quite recently as a mode of service provision, through the adoption of the Public Private Partnerships Act, 2012.

Public partnership has influenced sustainability of water supply projects globally. Target of the Millennium Development Goal on Water and Sanitation mandates that the number of people without sustainable access to water and sanitation be reduced by half by 2015. Kisumu City is said to be making good progress towards this target: access to improved water sources increased from 62.5 percent in 2001/02 to 65 percent in 2007, and projections indicate that by end of 2017, about 83 percent of the population will have sustainable access to an improved water source. A key obstacle is addressing unique water and sanitation problems facing populations living in informal settlements and peri-

urban areas. These include unreliable water supply, less advanced technology, high water prices, and poor quality of water from sources such as shallow wells.

1.3 Purpose of the Study

The purpose of this study was to determine the influence of public private partnership on sustainability of water supply projects: case of KIWASCO, Kisumu County, Kenya.

1.4 Objectives of the Study

This study was guided by the following research objectives:-

- i. To establish how funding influence sustainability of water supply projects in Kisumu County, Kenya.
- ii. To assess how technological innovation influence sustainability of water supply projects in Kisumu County, Kenya.
- iii. To assess how environmental risk influence sustainability of water supply projects in Kisumu County, Kenya.
- iv. To determine how economic diversification influence sustainability of water supply projects in Kisumu County, Kenya.

1.5 Research Questions

- i. How does funding influence sustainability of water supply projects in Kisumu County, Kenya?
- ii. How does technological innovation influence sustainability of water supply projects in Kisumu County, Kenya?
- iii. How does environmental risk influence sustainability of water supply projects in Kisumu County, Kenya?
- iv. How does economic diversification influence sustainability of water supply projects in Kisumu County, Kenya?

1.6 Significance of the Study

It is hoped that the findings of this research would be significant in providing information between the Government and other Public and private sector bodies on the advantages of

Public-Private-Partnership and how synergy is created between the two parties. The findings would be of significance to Public-Private-Partnership on assisting the government in meeting its service delivery to the people by accessing the technical and financial capital in areas that the government would not successfully undertake without affecting service delivery in other basic areas.

This study is also hoped to be significant to the state corporations, contractors and other stakeholders in the construction industry because it would highlight some of the factors which are influencing the performance of public-private-partnerships in the water and sanitation sector and hence they would institute measures to mitigate these constraining factors. The information gathered and presented in this study would serve as a guideline in the decision making for the parties concerned especially on public private partnerships.

The policy justification of this study is hoped to be of significance in the formulation of policies for Public-Private Partnership arrangements to avoid any legal disputes. Despite the fact that several PPP arrangements have been registered in the provision of public services/goods especially in Security, Health, Transport, and Water sectors in Kenya, to date there is no official policy on the public-private partnerships in Kenya.

For researchers and academicians, this study is hoped to be significant in acting as a source of reference in future relevant research topics. In addition, this study would provide areas for further research where future scholars could explore to widen the knowledge base on Public-Private-Partnership. The findings of this study would be important to scholars in the field of Public-Private-Partnership hence promote Public-Private-Partnerships in the future.

1.7 Basic Assumptions of the Study

The study assumed that Public Private Partnership influences sustainability of water supply projects. It also assumed that the private sector has a major role to play in the sustainability of water supply projects. The study assumed that all respondent had knowledge of public private partnership in sustainability of water supply projects and that were able to respond freely, correctly and accurately to the questionnaire. It also assumed

that the population is normally distributed and the sampling method employed yielded a representative population, it further assumed that the instrument for data collection is valid and reliable. It was assumed that the variables used in the study did not change in the course of the research period

1.8 Limitation of the Study

The limitations of this study were: time constrain, high cost, uncertainty by respondents on confidentiality of information shared and poor weather. The researcher had to involve more than one research assistant in order to collect adequate data within the allocated timeframe. The researcher also solicited for more funds to help pay for extra incorporated research assistant. During the interview some of the respondents were reluctant to share their income and savings situation as a result of water supply from KIWASCO. This was handled by the researcher by instilling confidentiality and assuring of privacy in the information shared. Poor weather and floods caused by heavy rainfall was another limitation that the researcher found remedy by postponing research work in flooded areas until the floods reduced. The researcher also provided gumboots and raincoats to research assistants.

1.9 Delimitation of the Study

The study was only carried out in Kisumu County on KIWASCO registered water users and its officials as the Key informants in the management of the company. The study was delimited only to cover KIWASCO as the main water supply in Kisumu municipality. This is because its existence was evidently founded by both private and public (government) partnership as a water supply project. Secondly, the population under study was limited to a sample population of the target group involving the KIWASCO registered water users in Kisumu County and its officials as the Key informants in the management of the company. The study was a descriptive survey research design study and the method of data collection tools employed in the study was Questionnaires

1.10 Definitions of Significant terms used in the study

Economic Diversification: This is generally taken as the process in which a growing range of economic outputs is produced. This diversification of income sources varies before and after the implementation of a water supply project among the water users and other beneficiaries due to the public private partnership.

Environmental Risk: In this regard, environmental risk is defined as the process by which the public-private partnership on water supply project determines what environmental information assets exist and what level of protection or measure is warranted based on the potential environmental risks that may impact on the sustainability of the project success .

Funding: This is the process of financing administered by a public organization, a company or the government created to manage finance water supply project to cover its expenses.

Public Private Partnership: A contractual arrangement between a public agency mostly the government and a private sector entity. Through this agreement, the skills and assets of each sector (public and private) are shared in delivering a service or facility for the use of the sustainability of water supply project.

Sustainability of Water project: It is well defined as about how private public partnerships manage financial, technological, social and environmental risks to ensure their water supply project can continue to operate, regardless of obstacles such as resource shortages, environmental disasters, and social and political events. It also relates to green practices and project continuity planning, as well as stakeholder engagement.

Technological innovation: This is the new science or knowledge put into practical use to solve problems or invent useful tools in water supply projects which is put into place through public private partnership.

1.11 Organization of the Study

This research project is organized into five chapters. Chapter one covers the introductory of the study, background of the study, public private partnership in the water supply, statement of the problem, purpose of the study, objectives of the study, the research questions, significance of the study, basic assumptions of the study, the study limitations, delimitations, and the definition of significant terms. Chapter Two covers the introduction, The concept of public private partnerships, public private partnership model in water supply, funding and sustainability of water supply, technological innovation and sustainability of water supply, environmental risk and sustainability of water supply, economic diversification and sustainability of water supply, sustainability of water supply project, theoretical framework, conceptual framework, knowledge gaps and summary of the literature review. Chapter Three consists of introduction, research design, target population, sample size and sampling procedures, sample size, sampling procedure, research instruments, pilot testing for the instruments, validity of the instruments, reliability of the instrument, data collection procedure, data analysis techniques, ethical considerations and operationalization of variables. Chapter Four covers research findings and discussions as per the objectives of the study. Under each objective, data was presented as follows: introduction, presentation of the results, highlights of the results and the interpretation of the discussed results. Chapter Five focused on the summary of the findings and practical implications of the results. It outlined the main findings of the study as drawn from chapter four. The chapter is the final chapter of the project research and also provided the conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter covers several sections that examine sustainability of public private partnership on water supply projects. This include The Concept of Public Private Partnerships, Public Private Partnership Model in water supply projects, Funding and Sustainability of Water Supply projects, Technological innovation and Sustainability of Water Supply, Environmental Risk and Sustainability of Water Supply projects, Economic Diversification and Sustainability of Water Supply Projects, Sustainability of Water Supply Projects, Theoretical Framework, Conceptual Framework, Knowledge Gaps and Summary of the Literature Review

2.2 The Concept of Public Private Partnerships (PPPs)

Public-private partnerships (PPPs) have had different meanings to various scholars. PPP is seen as a new governance tool that will replace the traditional method of contracting for the provision of public services through competitive tendering. Others see PPP as a new expression in the language of public management, one intended to include older, established procedures of involvement of private organizations in the delivery of public services (Stottman, 2000). There are also those who apparently use the terms “contracting” and “public–private partnership” interchangeably. Graeme and Carsten (2007) have categorized, broadly, the conceptualizations into two - A group that regards PPPs as forms of institutional and financial arrangements and the other that sees it as basically a “language game”.

The school of thought that views PPPs as institutional and financial arrangement is led by Akumu (2006). The proponents of this school of thought argue that both the private and public sectors have specific qualities which when combined, result in better services/products. The implied argument is that a synergy of effectiveness of state bureaucracy and the efficiency of the private sector shall yield improved quality of public services and goods by infusing market principles.

Public management scholars led by van Ham and Koppenjan (2001) define PPP as a cooperation of some sort of durability between public and private actors in which they jointly develop products and services, share risks, costs and resources which are connected with these products. Savas (2000) and Teismann and Klijn (2002), argue that the language of PPPs is a game designed to “cloud” other strategies and purposes.

However, some of the limitations of Public Private partnership as depicted in a study done in USA Government at all levels in the United States has been slowly moving away from grand central planning schemes and toward markets. One result has been the rise of public-private partnerships (PPPs). Proponents of these arrangements argue that many of the information and transaction cost problems inherent in government institutions can be mitigated by sharing construction, maintenance, and operational responsibilities with profit-motivated private firms. When the status quo is a government monopoly, PPPs should be viewed as preferable in nearly every case (Ajakaiye and Ncube, 2010).

Similarly, one of the limitations is that PPPs can also drive rent-seeking behavior, and create significant risk of improper collusion between political actors and politically preferred firms and industries. This harms not only taxpayers, but the economy at large, as critical investment decisions are distorted by political considerations. Such shady dealings also serve to delegitimize and discourage privatization efforts and commercial infrastructure investment in general. Worse still, the errors of the public sector component are often blamed on private parties (Yescombe, 2007).

A study conducted by the Indian government implemented twenty four hours seven days a week water supply projects in few selected cities. These projects were implemented either under Public Private Partnership (PPP) or direct funding by government. However, many projects witnessed failure during later stage of project life cycle (Alesina, William and Sergio, 2003). The paper aimed to carry out performance evaluation of implementation of continuous water supply projects against the various risks. The case study research methodology was adopted for the study. Initially, various risks in water supply projects were identified through literature review. Two polar cases were selected

for the study, one was implemented under Public Private Partnership (PPP) and other was implemented under direct funding from government budget.

2.3 Public Private Partnership Model on Sustainability of Water Supply Projects

Several studies have found that the private sector is more efficient at management of construction, service delivery, and asset maintenance. PPPs were found to reduce construction time and cost overruns unlike government-managed construction, which often runs over budget and falls behind schedule (Asayehegn, 2013). This is because PPPs usually do not allow adjustment of contract price for cost changes. Return for the private party depends on bringing the project in on time and budget, which means that private companies formulate more careful and conservative cost estimates from the start (Rajan, 2011). Some studies of PPPs in urban water utilities have found significant efficiency gains achieved through involvement of the private party, including reduced water losses, increased staff efficiency, coverage, and daily hours of service. Service delivery by government entities is often poor because limited capacity and lack of management incentives increase the cost. Furthermore, some types of PPPs reward improved utility service quality directly through performance-based contracts (Yirga, 2004).

The selected cases, drawn from both EU Member States and Candidate Countries, (Germany, Romania and United Kingdom) are illustrative of a generalized international trend to use PPP models in the water sector (Bunclark, 2012). From the wide variety of international examples, a group of cases was selected to demonstrate several PPP models and the impact of Commission co-financing. In particular the cases demonstrate the following: ·The differences between the privatization process, the development of PPP projects and the development of long term markets for water assets and operating rights (Martey,2007). ·The ability of Commission co-financing particularly to improve operational efficiency and fairness of a PPP agreement by promoting a more equitable distribution of the costs and benefits through standards and market regulation mechanisms (Robert, 2006). ·

The ability of PPPs to capture the value of private sector expertise and new technologies in complex projects (Wahaga, 2012). The ability, through incentives and risk transfer, to generate increased speed of project realization and to create operational efficiencies. The fact that the PPP approach does not need to result in reduced concern for environmental issues, service quality standards or social and employment concerns. Some of the findings indicated that On the basis of the project selection criteria the main common lessons learned can be summarized as follows: There is a considerable difference between privatization and PPP principles. This is particularly true in the water sector and in new Member States (Makhura, 2006). It has been common practice, particularly in the Candidate Countries, to firstly privatize assets and then develop and implement a PPP project to attract investment and know-how. This is evident in the Bucharest, Trencin, Karvina and Berlin cases. Of major concern is the method of asset transfer and their accounting in the subsequent PPP project. It is to be expected that the State wishes, at least initially, to maintain a degree of control over public services and thus, may wish to retain control over fixed assets (Kirsten, 2000).

The degree of risk transfer is a crucial issue to the success of PPP projects. Particularly in environmental projects there is a confluence of standards, liabilities, service and quality provision targets and, in many countries, a need to establish the principle of full user charges for services (Asante, 2006). This adds to revenue risk and requires a suitable approach to the structuring of the agreement and the commitment of all parties to the sustainability of the project. In this case the availability of data allows public scrutiny of performance against targets and hence pressure on user charges if performance is not satisfactory. This 'consumer pressure' provides an added incentive to increase the provision of value for money (Nedumaran, 2009).

A study done in South Africa, on public partnership model in water supply, at the start of the PPP process which led to the contracting of the Siza Water Company the institution which initiated the processes was the Borough of Dolphin Coast a transitional local authority formed out of the post municipal restructuring processes (Khalkheili,2003). Subsequent to this, government embarked on a process to define regulations under which frameworks for contracts between water service authorities and

water service providers as defined within the Water Services Act (1997) would operate. These processes began to give relatively specific guidelines under which a variety of water service delivery arrangements, ranging from public to fully privatized, could be considered (although, as will be discussed later, it should be noted that the Dolphin Coast concession was conceived and implemented before these regulations were finalized) (Zamani,2000).

2.4 Funding and Sustainability of Water Supply Projects

Water Supply and Sanitation projects utilize three forms of capital-natural capital (water), infrastructure capital and skillful management of human and financial capital, each form of which must endure in order to achieve sustainability (Hodgkin, 2004). This section represents past studies on funding and sustainability of water supply as illustrated below.

A study Conducted in United Kingdom to explore factors influencing rural water sustainability, a descriptive survey design was undertaken covering 42 villages in rural communities. The findings indicated that rural community water supply requires a capital contribution from the users, either in-kind (labor and local materials) or, if in cash, in the region of five percent of the capital cost (Biller and Andres,2014). This is rarely recovered however, and so improved services are by default a gift (albeit often with some community participation in construction) from the government or NGO to the community or private organization. There is disagreement among practitioners about whether user cash contributions to capital costs help to cement community ownership of rural water supply systems and so contribute to sustainability (Dappe and Basnyat, 2013). However, there are cases in which a cash contribution to capital cost is raised but then ring-fenced for the water supply, for instance by putting it into an operation and maintenance account on behalf of the community. In this way it is of direct benefit to the users. The only approach to rural water supply in which the users pay the full capital costs of new or upgraded water points is „self-supply“ (Barlow and Köberle-Gaiser, 2008).

Regionally, in a study done in developing countries in Africa, public private partnerships have been implemented on a lower scale than in the developed countries. Sheppard et al. (2007) show that Sub-Saharan Africa receives only a small share of private funds

targeted for foreign PPP investment in infrastructure (Briceño-Garmendia,2007). They suggest that this could be a consequence of the difficulties in accessing project finance mostly because of the low creditworthiness of most African countries, the limits of local financial markets, and the adverse risk profiles typical of infrastructure projects. They further indicate that the ability of the region to attract more private foreign currency funding for infrastructure depends in part on the ability to reduce foreign exchange risks. Alexander (2008) indicates that the World Bank (WB) Group through its private sector arm, the International Finance Corporation (IFC) supports PPPs in Africa through the Sustainable Infrastructure Action Plan (SIAP). Vidigni (2002) has underlined how cooperation can take place in an organization where decisions are taken and implemented jointly. However, an economic aspect of the PPP model cannot be overlooked as it involves substantial finance by both the public and the private sector in PPP projects.

Public private partnerships in all sectors including infrastructure financing were introduced in South Africa in the year 2000 (Russell and Bvuma, 2001). This was after implementation of reforms geared towards new public management including the enactment of the Public Finance Management Act of 2000 to guide PPPs contracting, implementation and evaluation (PPP Unit, 2003). According to their model, value for money is only achieved if all appropriate risks are transferred to the private sector. The lessons the PPP experiences offer in the country are that there is need for regulatory framework that is effective, affordable and which offers value for money. The PPP Unit (2003) also suggests that procedural certainty coupled with technical assistance and political goodwill can boost infrastructure projects. Ultimately, development of capital markets would enhance accessibility to private debt finance for facilitating PPPs (Collier, 2014).

A study commissioned by Water Aid to explore the reasons behind non functionality of distribution points in central Tanzania (Mays, 2007). The research was initiated after a water point survey revealed average functionality rates among public distribution points of just 45%. Similarly low rates of functionality haunt development practitioners the world over, despite the use of technologies and social strategies purported to increase sustainability. To explore the causes of non-functionality of distribution points, a

purposive survey was undertaken covering 38 villages in six different districts in Dodoma and Singida regions. It captured both quantitative and qualitative data (Chijoriga, 2014). A range of aspects were examined: technological, management, demand and socio-economic status across a range of hydro-geological and policy environments but the main agenda was to determine how presence of funding affect its sustainability.

Findings of the research indicated that poor financial management were the primary correlate of non-functionality. Therefore the main elements of financial management are explored in detail in the rest of the report. Revenue collection was weak in the majority of villages, improved by the introduction of a private operator. The report emphasizes the need for pricing based on achieving full cost-recovery; an aim found not to be entirely unrealistic. Simplicity in management structures is recommended (Schneier, 2006). Flat-rate contributions and a punitive bond are highlighted as important elements of the private operator's contract. There is currently an absence of regulation at the village level, a role that could usefully be performed by district WAMMA teams. The on-going use of alternative sources is found to undermine cost recovery, but also highlights the priority given by users to water softness. Orthodoxy surrounding concepts of ownership and participation are challenged, inviting a re-examination of the responsibilities of implementing agencies and donors in achieving sustainability (Courel, 2010).

These systems also do not have clear accountability records and this may make community members doubt such systems making them draw back in contributions (Komba, 2014). Once a project cannot generate enough revenue from beneficiaries, its sustainability will be threatened as repairs and maintenance cannot be provided for when need arise. Misappropriation of funds collected as a result low or lack of professionalism may also contribute to poor CCCs leading to poor maintenance and thus lack of sustainability (O'Flynn, 2009).

Another study was done to investigate the factors influencing sustainability of donor funded community water projects in Kitui central constituency, Kitui County, Kenya. The study sought to establish how financial sustainability of water projects funded by donors, to investigate how management affect sustainability of water projects funded by donors,

to determine how financial administration influence sustainability of water projects funded by donors in Kitui central constituency (Caspary, 2009). Data for this study was collected using the questionnaires as the main research instruments. The questionnaires were administered to 35 respondents composed of the 31 chairpersons and 4 coordinators. The collected data was analyzed using both descriptive and inferential statistics. Simple random sampling was used to select the respondents to be included in the study. Finally the study established that majority of the respondents indicated that the financial records are never audited. This is likely to affect the financial management of the water projects (Cutanda and Paricio, 2004). Also majority of the respondents mean responses agreed that the reasons behind lack of financial skills are illiteracy, poor record keeping, and misappropriation of resources. There is a strong positive correlation community financial management($r = 0.76$) and sustainability of donor funded community water supply projects supplies (Musyoka, 2003).

2.5 Technological innovation and Sustainability of Water Supply Projects

Water technology that fails to fulfill the needs of its users, which is poorly installed or which is difficult to maintain or repair, possess significant challenges for sustainability. Water Aid's recent sustainability study in Zambia highlighted, for example, the rapid corrosion of hand pump rising mains as a constraint to sustainable community water supplies (Len Abrams, 2003). There is no such thing as a maintenance-free technology yet even gravity water supply schemes, which were expected to provide sustainable services, have failed to live up to that promise. This section represents past studies on technology and sustainability of water supply (Davis and Lyer, 2002).

In a study conducted in India on the use of technologies and pumps that require village level operation and maintenance. Descriptive research design was used in the research with a sample size of 256 village water users. The study findings revealed that approximately a third of India's hand pumps in rural water projects are either nonfunctional or in need of repairs. The Government of India (GOI) created demand so that private companies stepped in to produce the hand pumps and spare parts (Isha, 2004). The GOI also trained engineers and mechanics to use and repair these new technologies at the community level so as to enhance ownership and sustainability of

community water projects (Mackenzie, 2005). However, the largely publicly funded hand pump programme was a remarkable success (Commonwealth Secretariat, 2013). Through the programme; access to safe water increased from less than 10 per cent to 31 per cent. This achievement was a result of Non-Governmental Organizations, NGOs using technologies and pumps that require village level operation and maintenance (VLOM).

In Ghana, a study conducted on factors responsible for the non-functioning of boreholes, survey research design was applied and a sample size of 96 bore holes was used. The study findings revealed that the factors range from extreme low yields, inability to raise funds to acquire spare parts, to lack of access to spare parts (Dacin, 2007). To sustain access to potable water, access to spare parts needs to be improved. Obsolete hand pumps should be replaced with modern ones to ensure easy access to spare parts in case of breakdowns. Study findings also indicated that water supply projects are influenced by the ease of operation and availability of spare parts for the technology incorporated in the water systems.

In a study conducted in Koro region of Mali, West Africa on factors influencing sustainability of water supply infrastructure, a case study research design was used with sample size of 108 water infrastructure. The study findings revealed that sustainability of various types of water supply infrastructure is dependent upon the degree to which the technology used corresponds to the needs of the local community and the community's ability to maintain and repair it over time (Gleitsmann, 2005). However, considering the non-functional state of most manual hand pumps in Koro, it is apparent that efforts need to be made to ameliorate the situation. Learning from previous development projects, the latest approaches are addressing the problems of limited availability of spare parts, absence of trained technicians at the local level and the limited role of women in the pump management scheme (Deephouse, 2006). These factors influence ownership of water projects by the beneficiary community (Mwakila, 2008).

Many studies and reports have documented the influence or effect of choice of technology on sustainability of water supplies (Bredero, 2003). Sector professionals have used a number of terms to describe affordable, simple technologies that could easily be adapted to local conditions and maintained by communities; among them-appropriate

technology, progressive technology, alternative technology, Village level Operation and Maintenance (VLOM) technology, Intermediate technology, Village technology, Low - Cost technology, Self-help technology and even technology with a human face (Brikke et al, 2003). Brikke et al (2003) suggested the use of “sustainable technology at the community level” and argued that projects must incorporate selection of appropriate technology and integrate Operation and Maintenance (OandM) into project development right from the start (Dethier, 2012).

Hardware (including pumps, pipes, and spare parts) is sourced and procured by international agencies, governments, private providers and NGOs. The questions around who buys, what is procured and how quality of hardware is assured are all important for sustainability (Moore, 2012). In particular the links between the community and the suppliers of spare parts are crucial. The community need to be trained on how to use the taps, springs, hand pumps among others and it should also be trained on how to maintain the facilities because the external institutions will not always be available in case of breakdowns (Diba, 2012).

Most of the community water projects are either hand pumps or taps (which have underground pipes) or springs and all these must be properly maintained to enhance their sustainability (Proasne, 2005). Argues that for water projects to give sustainable results, Project Managers should ensure that there will be funding to support identified solutions to the problems in long term, and for this to happen it is necessary that the technologies used be cost effective and CMs receive instructions on the new techniques as well as training on how to maintain and repair the equipment (Estache and Goicoechea, 2006). Cost effective technologies will give CMs a humble time in terms of repair and maintenance, and this will enhance sustainability of the project. Njonjo and Lane emphasizes that without official policy to restrict the range of hand pumps in East African region, a large number of hand pump manufacturers will continue to flood this region with obsolete machines. They add that this will continue to increase operational costs and hence further aggravate the problem (Trujillo, 2006).

An analyses of the performance of water systems in a variety of countries found that performance was markedly better in communities where households were able to make

informed choices about the type of system and the level of service they required (Katz and Sara, 2007). Among technical factors suggested to contribute to sustainability of services is technology selection, complexity of the technology, the technical capacity of the system to respond to the demand and provide the desired service level, the technical skills required to operate and maintain the system, the availability, accessibility and the cost of spare parts and the overall cost of OandM (Esty, 2000).

System design and the complexity of the technology involved will clearly have a bearing on the relative weighting of these factors (Kharas and Sierra, 2011). In the case of hand pumps for example, standardization of pump types, spare parts, support to the private sector for local repairs and institutional arrangements on the part of government in support of community management were all seen as vitally important factors in the sustainability of projects in Africa according to recent research by WEDC (Harvey et al, 2002). Sustainability of facilities provided is enhanced by involving the private sector in the direct provision of services to communities and emphasizing sound financial management and adequate cost recovery by community-based organizations. All of the above evolve with a legal and institutional framework. At national level there must be clear policies and strategies that support sustainability (Brikke et al, 2003). Support activities such as technical assistance, training, monitoring and setting up effective financing systems are all likely to influence effectiveness of OandM.

Settlement pattern of a community also influences the choice of water supply technology and OandM (Kimenyi, 2009). For example, a hand pump would serve only a limited number of people in a settlement structure where households are located on individual farms. Ground water characteristics also influence choice of technology. For example, the choice between a hand pump based system and a diesel powered system will be influenced by the size and depth of the ground water and demand or population to be served.

2.6 Environmental Risk and Sustainability of Water Supply Projects

Environmental risk implies future environmental uncertainty about deviation from expected earnings or expected outcome on water sustainability projects. Risk measures

the uncertainty that a water sustainability project is likely to face or take which can affect its productivity in the long run (Davis, 2005).

Research studies in North America on public private partnership on water supply projects indicated that climate change may be a factor leading to increased risks of food and waterborne illnesses from consumption of existing and emerging biological hazards (Martinsons, 2008). It is beneficial to develop integrated approaches to evaluate, and provide scientific assessments of, potential climate change adaptation measures to inform risk management related to climate and weather events. To this end, a risk modeling framework was created to facilitate estimations of the impact of weather and climate change on public health risks from biological hazards in food and water and to compare potential adaptation and risk mitigation strategies (Ashgate and Lepenies, 2008). The framework integrates knowledge synthesis methods, data storage and maintenance, and stochastic modeling. Risk assessment models were developed for food and water safety case studies for demonstrative purposes. Scenario analyses indicated that implementing intervention measures to adapt to changing climate impacts might mitigate future public health risks from pathogens to varying degrees (Mengistu, 2006). The framework brings a generic approach to allow for comparison of relative public health risks and potential adaptation strategies across hazards, exposure pathways, and regions to assist with preventive efforts and decision-making. Therefore, risk models were developed to provide estimations of potential impacts based on simplifications and generalizations of processes that are in reality, highly complex and associated with high degrees of uncertainty (OECD, 2002).

In a study done in South Africa and the surrounding Mediterranean islands suggested that population growth will have a large effect on urban water shortage in public private partnerships geared towards water supply sustainability (Biousse, 2014). Climate change will cause an additional increase in water shortage on top of these demographic effects. Population growth and climate change together pose a significant challenge for urban water managers, but one that can be foreseen and planned for well in advance (Brikke et al, 2003). Of course, significant uncertainties cloud all forecasts, and ours present no exception. Long-term demographic forecasts can be rendered misleading by inadequate

data or made inapplicable by unforeseen events. Nevertheless, in the next few decades we expect the effects of urban growth to be stronger and generally less uncertain than climate change in most settings. Climate change forecasting is inherently more difficult than demographic forecasting, because climate modelers must predict the consequences of a novel experiment on the Earth's atmosphere (Miyamoto, 2013).

Precipitation, of obvious importance for a city's water balance, is particularly difficult to forecast. Some impacts of climate change on hydrology, such as more frequent flooding, could impact (positively or negatively) local water supply; our analysis does not account for phenomena in the hydrologic cycle that occur more quickly than the monthly time-step of our models, such as flooding (Whittington, 2008). Similarly, our analysis does not fully account for changes in snowpack or the timing of snowmelt, which can significantly impact some cities' seasonal water supply. Despite these uncertainties, predictions of water shortage based on the best available data can and should inform planning by water managers. For cities that find themselves in a state of water shortage, there are two types of solutions (Akabang, 2009).

First, water shortage can be viewed as an engineering challenge, with an infrastructure solution. For cities with seasonal water shortage, more water storage from dams or other impoundments may be the solution, although changes in the seasonal distribution of water availability due to climate change may complicate matters (Kharas and Sierra, 2011). For perennial water shortage, long-distance transport from somewhere beyond the 100-km buffer may be a solution. For cities near the coast, desalination may be an option. Finally, cities on top of a large aquifer may choose to unsustainably mine groundwater, removing water faster than aquifer recharge and putting off water shortage by a few years or decades (Komives, 2007).

Second, water shortage can be alleviated through landscape management and more efficient use of this resource. Agriculture is the major consumptive use of water globally, and even small gains in agricultural water use efficiency might save substantial quantities for urban dwellers (Munnell, 2000). Similar efficiency gains in the industrial or residential sector may also save significant quantities of water (Cook, 2001). More

generally, changes in land use or land management may free up water for urban dwellers or for the environment. In part of the southwestern United States, for instance, cities sometimes pay farmers to purchase the water the farmers have traditionally put on their fields, in effect freeing up water for cities by reducing the area of irrigated agriculture Wade (2007).

Another study was done in Kisumu, on risk assessment done on water drinking and treatment due to acute water shortage. Traditionally, economic modeling of behavior that involves risks has relied on risks as specified by scientists or so-called experts. However, the designation of experts has itself been called into question (Rowe, 2001), and many believe that an individual's subjective or perceived risks are likely to better explain an individual's behavior than science-based risks (Slovic, 2007). Acute water shortage (absolute scarcity), declining quality and poor sanitation has been an enigma in Kisumu city despite its proximity to the second largest fresh water lake in the world, Lake Victoria. Weak implementation of by-laws, societal attitude, corruption, outdated technology, a poor financial base and managerial skills have been cited as some of the causes (Wright, 2006). For a long time, water vendors have cashed in on the shortage and reaped profits. The higher cost of water in informal settlements is attributed to lack of infrastructure that would allow residents to get water directly from the Kisumu Water and Sanitation Company (KIWASCO). Laboratory experiments have often indicated that individuals tend to underestimate high-risk events and overestimate small-risk events, and their perceived risks are often strongly different from those based on scientific studies. Recent research on drinking water behavior suggests that subjective risks or at least subjective measures of "safety" related to or other contaminants are likely to be very important (Poe and Bishop, 2009)

2.7 Economic Diversification and Sustainability of Water Supply Projects

This is generally taken as the process in which a growing range of economic outputs is produced. This diversification of income sources varies before and after the implementation of a water supply project among the water users and other beneficiaries due to the public private partnership (Bakalian, 2005). This section represents past studies

on creation of economic diversification and sustainability of water supply as illustrated below.

A study was done in USA on economic diversification brought about by water sustainability (Larbi, 2004). The main aim of the research was to evaluate water supply diversification efforts through an integrated water management approach with a focus on institutional issues and economics. There was also the aim to identify and highlight key opportunities and challenges of integrated water resource and land use planning. With a focus on water supply diversification, the research will look to leverage lessons learned from other aspects of water resource management (e.g., demand management, storm water management) as well as other sectors (e.g., transportation) to better inform what approaches and techniques might be available to support supply diversification and continue to improve the integration of water resource and land use planning (Ncube, 2010). The ultimate aim of this research is to develop a comprehensive summary of the research findings as well as a collection of guides and resources that can be used directly by the water utility, land use, and development communities to promote supply diversification and demand management, with a geographic component that emphasizes key considerations by region (Nkeri, 2014).

The findings of the study indicated that Per capita water use has been steadily declining since the 1980s while the distribution of water withdrawals between sectors has remained relatively steady. When examining consumptive use, the portion of the withdrawal that is no longer available within the watershed, the significance of agricultural uses and public supply is magnified at 67 and 25 percent of total consumptive use respectively (Pistor, 2000). If only gross water withdrawals are considered public supply and domestic self-supply drop in half to only 13 percent of total withdrawals. This is due in large part to the large non- consumptive impact of the thermoelectric power sector (Thorsten, 2007). Some other findings indicated brings more advantage to the economy. For instance, Energy savings realized by reducing the amount of water transported long distances, and reducing the amount of water treated to potable standards, Ecological improvement and improved aquatic habitats realized by leaving more water in streams preserving groundwater supplies at sustainable levels, Storm water management provided

by the distributed storage of harvesting basins that are used both to control flash flooding while also providing an alternative water supply option, Economic growth realized through having a stable water supply that can help attract industry requiring high quality and reliable source water, Financial benefits realized by better matching water source and use and only treating water to the standard required for the desired end use and Community resilience realized by diversifying water supplies and reducing the impact of stress on any one supply (Martin,2000).

In a study done by United Nations in Nigeria on public private partnership on water supply sustainability indicates that, an estimated 663 million people lack ready access to improved sources of drinking water, while the number of people without reliable access to water of good enough quality to be safe for human consumption is at least 1.8 billion (UNICEF/WHO, 2015), and possibly significantly more. More than one third of the global population some 2.4 billion people do not use improved sanitation facilities; of these, 1 billion people still practice open defecation (UNICEF/WHO, 2015). The study findings indicated that Agriculture accounts for roughly 70% of total freshwater withdrawals globally and for over 90% in the majority of Least Developed Countries (LDCs) (FAO, 2011). Without improved efficiency measures, agricultural water consumption is expected to increase by about 20% globally by 2050 (WWAP, 2012). Globally, some 38% of irrigated areas depend on groundwater (Siebert et al., 2013), which has contributed to a ten-fold increase of groundwater abstraction for agricultural irrigation over the last 50 years. At the same time, almost half of the world's population depends on groundwater for drinking (Tushaar et al, 2007). Projected increased water demand, primarily from manufacturing, electricity and domestic use will generate further stress on water resources and possibly impact water allocation for irrigation (OECD, 2012). Overall, industry (including energy) uses about 19% of the world's total water withdrawal (FAO, 2014). According to the IEA (2012), energy uses about 15% of the total, which implies approximately 4% for large industry and manufacturing (but not including all the small- and medium-sized industries which receive water from municipal distribution systems). However, it is predicted that by 2050 manufacturing alone will increase its use by 400% (OECD, 2012). Water demand for energy, and electricity

generation in particular, will also grow significantly (WWAP, 2014), as energy demand is expected to grow by more than one third in the period 2010-2035, with 90% occurring in non-OECD countries (IEA, 2012).

In Nairobi Kenya, According to the survey conducted in 2005 by the World Bank, about 67 % of the population has access to a water-borne sewerage system, and the rest relies on on-site treatment facilities and other measures for disposal of the waste water (Mugwe, 2011). More than 90% of the population has been served the pipe water by the company either through house connection and public taps. There are four sources of water supply: Kikuyu Springs, Ruiru reservoir on the Ruiru River, Sasumua Reservoir on the Chania River, and Chania River gravity intake (Musyoka, 2012). These are capable of supplying of 217,000 m³ /day at a reliability of 90 %. The water demand of the city is forecast at 363,400 m³ /day in 2000, 450,200 m³ /day in 2005, 557,700 m³ /day in 2010, and 806,600 m³ /day in 2020. There is a great gap between the supply capacity and the demand. The company is therefore forced to rationing supply system in some areas. This has led to less creation of economic diversification brought about by Nairobi Waters and Sewerage Company (World Bank, 2006).

2.8 Sustainability of Water Supply Projects

Sustainability is a problem which faces almost all developments, in industrialized countries as well as in the developing ones .It is as well defined as about how organizations manage financial, social and environmental risks to ensure their water supply project can continue to operate, regardless of obstacles such as resource shortages, environmental disasters, and social and political events. It also relates to green practices and business continuity planning, as well as stakeholder engagement (Mwangi, 2012).

In recent years the debate took on new urgency through the adoption of Agenda 21 at the Earth Summit conference in Rio de Janeiro in June 2012. In the global debate sustainability was considered primarily in terms of continuing to improve human well-being, whilst not undermining the natural resource base on which future generations will have to depend (Abrams, 2013).

Sustainable development is defined as “one that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Commission, 2007). This means that a sustainable project must meet the present as well as the future human needs and aspirations. It must be one whose outputs and services are maintained continuously over time and keeps that focus with its original goals and objectives (Stanislaw, 2000). Projects are designed and implemented to achieve certain set goals. Some projects require that their activities be sustained over time to ensure continued flow of set outputs hence achieve desired change that could be social, cultural or economic. Water projects are implemented to ease accessibility of the community members to clean water and hence improve their well-being (quality of life). Implementation of these projects is always successful but their sustainability poses a challenge (Powell, 2001).

A study on factors affecting the sustainability of rural water supply systems in Mecha-Woreda, Amhara region, Ethiopia, defines sustainability as the functionality of a water point over a long period of time (Habtamu, 2012). The determinants of sustainability of water supply systems are categorized into pre implementation factors and post implementation factors (DiMaggio, 2001). Pre-implementation factors includes community participation, technology selection, site selection, demand responsiveness, construction quality, population and training while post-implementation factors are technical support, community satisfaction, institutional and financial management, training and willingness to sustain the water project (Gebrehiwot, 2006).

Key indicators of sustainability have the following components. First, reliability of the systems which implies that in community based systems, there has to be availability of spare parts and local skills to operate and maintain facilities to ensure that the system remains functional (Judge, 2007). Secondly, the sources of water have to be reliable and this may be guaranteed by water resources conservation (Wijk-Sijbesma, 2015). Thirdly, local institutional capacity with an autonomous management structure is an important component of sustainability. Management of the projects should have the flexibility to implement any necessary remedial measures (Robbins, 2005). Cost sharing for operation and management should be considered as users in the community need to contribute

resources to make the project sustainable. Resources required for operation and management should be within the capacity of the community to provide. Interagency collaboration between communities, Governments, Non-governmental organizations, the private sector, research institutions is required both in planning and implementation of community water based projects (Odendaal, 2006).

A Triple-S scoping study on rural water supplies in Ethiopia found that sustainability of rural water facilities is a major issue and one that is now receiving greater attention (IRC, 2011). The study found that levels of non-functioning facilities are high affecting service delivery for many, while post construction support for community management is extremely low. Yet, Water and Sanitation Programme (WSP)-Africa in its report on “Sustainable Management of Small Water Supply Systems in Africa, Field Note, (2010)” said sustainable rural water supplies are important for the growth of local economic hubs. The report found the growth of rural centers and small towns ranging in population from 2000 to 50,000 people are of considerable strategic importance for economic and social development in Africa, contributing to curbing rural urban migration and the accumulation of the unemployed poor in the slums of large cities (Siemiatycki, 2009).

The history of water supply and sustainability to Nairobi since the city was founded as a rail outpost in 1899 has been to a large extent a history of tapping ever more distant water sources to supply a rapidly expanding city with sufficient water (Ombok, 2009). Other challenges faced included the reduction of water distribution losses, reaching the poor in slums, expanding sewerage and wastewater treatment, and strengthening the Nairobi water utility (Springer Science Business Media, 2000).

A study was done to contribute to our knowledge and understanding of factors contributing to the failure of community based rural/urban water supplies and supports the sector to develop training packages and models for training communities and middle level trainers of trainers to improve sustainability of rural/urban water supplies to Narayan (2005). The training packages benefit staff of the Ministry of Environment, Water and Natural Resources and other stakeholders to improve future sustainability of rural water supplies (Nderitu, 2013). A descriptive sample survey of 777WASH

Committees and household representative's from 259 rural water facilities in 3 districts- Kisumu and Siaya in Nyanza and Busia regions in Western Kenya were surveyed. A 10% sample using stratified random sampling was used to select respondents.

Data was collected by the use of questionnaire method using two sets of questionnaires, one each of the water management committee members and the other for households (Mwangi, 2012). The questionnaires were pilot tested to determine suitability to both the committee members and households. The study findings indicated sustainability of community based and managed rural water supplies in Kenya remains a challenge. In spite of concerted efforts to transfer ownership of rural water supplies to beneficiary communities and increasing participation of the communities in the operation and maintenance of these facilities, more than a third of all rural water supplies fail within three years of development (Nguri, 2009).

2.9 Theoretical Framework

Theoretical underpinning of this study is public choice theory supported by this model and as explained and outlined in figure 2.1 below.

2.9.1 Public Choice Theory

Public choice theory seeks to explain and predict the behavior of politicians and bureaucrats in the policy by using analytical tools developed from economics, based on the principle of rational choice. Major contributors to the theory include James Buchanan, Gordon Tullock, and Mancur Olson. James Buchanan and Gordon Tullock coauthored *The Calculus of Consent: Logical Foundations of Constitutional Democracy* (1962). The theory, which attempts to look at governments from the perspective of the bureaucrats and politicians, is known as the Public Choice Theory. The Theory uses modern economic tools to address problems in the field of political science. In public choice, individuals, interest groups, bureaucrats, and politicians are assumed to seek their own self-interest as in the market place (Koppenjan, 2004). Decisions made depend on the costs and benefits of an action taken whereby each group attempts to maximize their own net benefits. Benefits can take the form of monetary or non-monetary rewards and may include ideologies, goals, and cultural values. Politics and the government create the

foundation upon which societies are built and also provide grounds for endless research about interactions of people, power and decisions. Twentieth century economists have addressed the complicated and intriguing questions of what processes occur when people make voting decisions and what happens in the minds of policymakers when they make decisions.

Public choice theory is now a well-developed and influential body of scholarship. As Mueller's description suggests, public choice involves questions that span different social science disciplines, and practitioners of public choice are as likely to be found in political science and economics departments as in law schools. Although public choice has been criticized for lack of empirical support, there is a huge body of empirical work on the propositions put forth by public choice theorists. This literature includes works in economics, sociology, political science, international relations and many other disciplines (Olson, 2000).

According to the policies indicated in this theory, the government. Public and private partnerships are all dependent on public choice on any project to be implemented. In this study, on the influence of public private partnership on sustainability of water supply project is a key aspect that relies on this theory for its success. The public has to have a voice and ultimately make it possible for the government and private partnership to take place.

In conclusion, public private partnerships in community projects are usually politicized. Public choice theory is often used to explain how political decision-making results in outcomes that conflict with the preferences of the general public (Mandell, 2002). It attempts to look at governments from the perspective of the bureaucrats and politicians who compose them, and makes the assumption that they act based on budget maximizing model in a self-interested way for the purpose of maximizing their own economic benefits. The theory applies economic analysis, usually decision theory and game theory, to the political decision-making process in order to reveal certain systematic trends towards inefficient government policies. The theory also assumes that good government policies in a democracy are an underprovided public good, because of the voters. While good government tends to be a pure public good for the mass of voters, there may be

many interest groups that have strong incentives for lobbying the government to implement specific inefficient policies that would benefit them at the expense of the general public. The main objective could be to access opportunities for businesses in a patron-client network. Sometime there is even the use of voting in or out on the ideas to be implemented in the projects planning and implementation process. This affects the program's running. Nevertheless the involvement of public choice and private partnership enhances proper decision making.

The public choice theory holds that a regulatory policy of the government that takes cognizance of the public good characteristics of water shall enhance an effective public private partnership between water service providers and stakeholders. The quality of services will therefore be enhanced in terms of affordability, quality; accessible water and good customer service (McGuire, 2014). It is unlikely, that good service delivery could be realized in a poor partnership structure. The production of public goods results in positive externalities which may not be directly compensated. If private organizations don't reap all the benefits of a public good which they have produced, their incentives to produce it voluntarily might be insufficient. Consumers can take advantage of public goods without contributing sufficiently to their creation.

2.9.2 Public Private Partnership Model on Sustainability of Water Supply Projects

Public-private partnership (PPP) is a funding and implementing model for a public infrastructure project in water supply and sustainability. The public partner is represented by the government at a local, state and/or national level (Daykin, 2000). The private partner can be a privately-owned business, public corporation or consortium of businesses with a specific area of expertise.

In Brazil the entire concept of PPP and private sector participation is a relatively new concept being implemented in the water sector (Reisman, 2000). Different models of PPP funding are characterized by which partner is responsible for owning and maintaining assets at different stages of the water supply project, Drummond MF et al. (2005). Therefore, the project supports evidence based policy advocacy and improvements at all levels. In addition, the project facilitates improved public education on the importance of

quality water by working through appropriate messaging channels; fosters improved mechanisms to engage and regulate private sector participation and market financing options; and supports research activities that provide an effective evidence base for ongoing policy and regulatory adjustments (Getnet and Kloos, 2013). Examples of PPP models include: Design-Build (DB) where the private-sector partner designs and builds the infrastructure to meet the public-sector partner's specifications, often for a fixed price. The private-sector partner assumes all risk. The second model is Operation and Maintenance Contract (O and M) where the private-sector partner, under contract, operates a publicly-owned asset for a specific period of time. The public partner retains ownership of the assets (Sharma, 2006). Design-Build-Finance-Operate (DBFO) is another model the private-sector partner designs, finances and constructs a new infrastructure component and operates/maintains it under a long-term lease. The private-sector partner transfers the infrastructure component to the public-sector partner when the lease is up. Build-Own-Operate-Transfer (BOOT) is where the private-sector partner is granted authorization to finance, design, build and operate an infrastructure component (and to charge user fees) for a specific period of time, after which ownership is transferred back to the public-sector partner. (Williams, 2017).

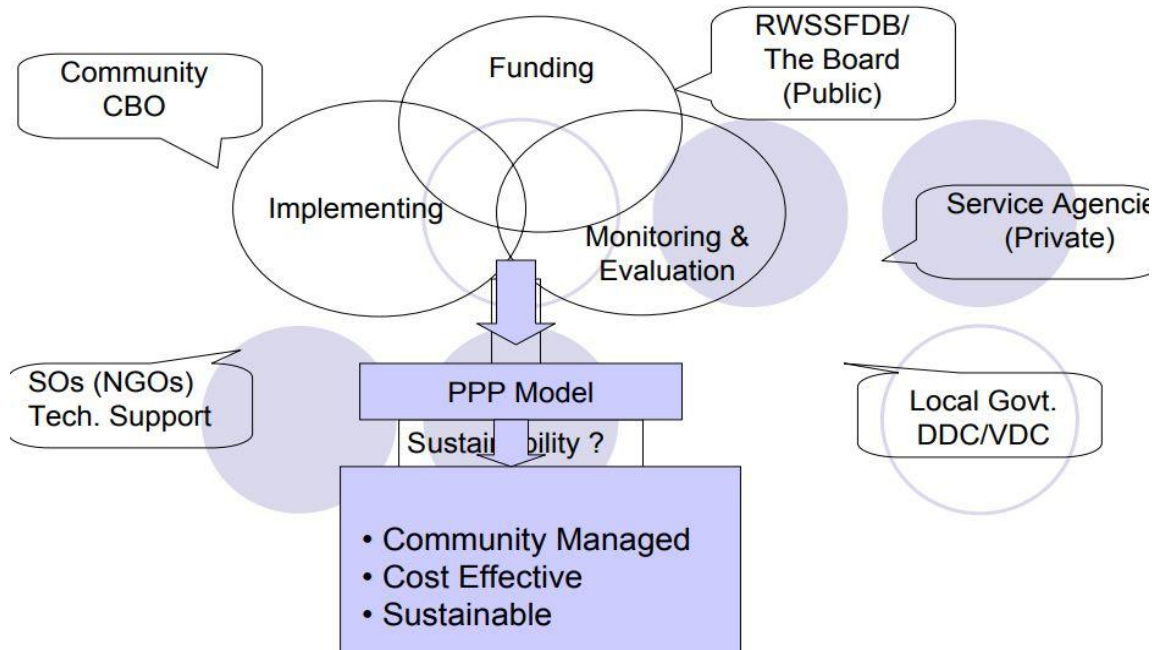


Figure 2.1: Public Private Partnership Model Water Supply Project in Brazil in 2011

2.10 Conceptual Framework

The conceptual framework in this study constitutes of independent variables, moderating factors and dependent variables. The independent variables are the variables which a study seeks to examine in order to determine their impact on a particular subject matter (Creswell, 2002). In this particular case, the following were the independent variables: Financing, Technological Innovation, environmental risk and economic diversification. The dependent variables are influenced by independent variables and in this particular case; the dependent variable for the study was sustainability of water supply projects. Figure 2.0 below presents a figurative representation of the conceptual framework of the study.

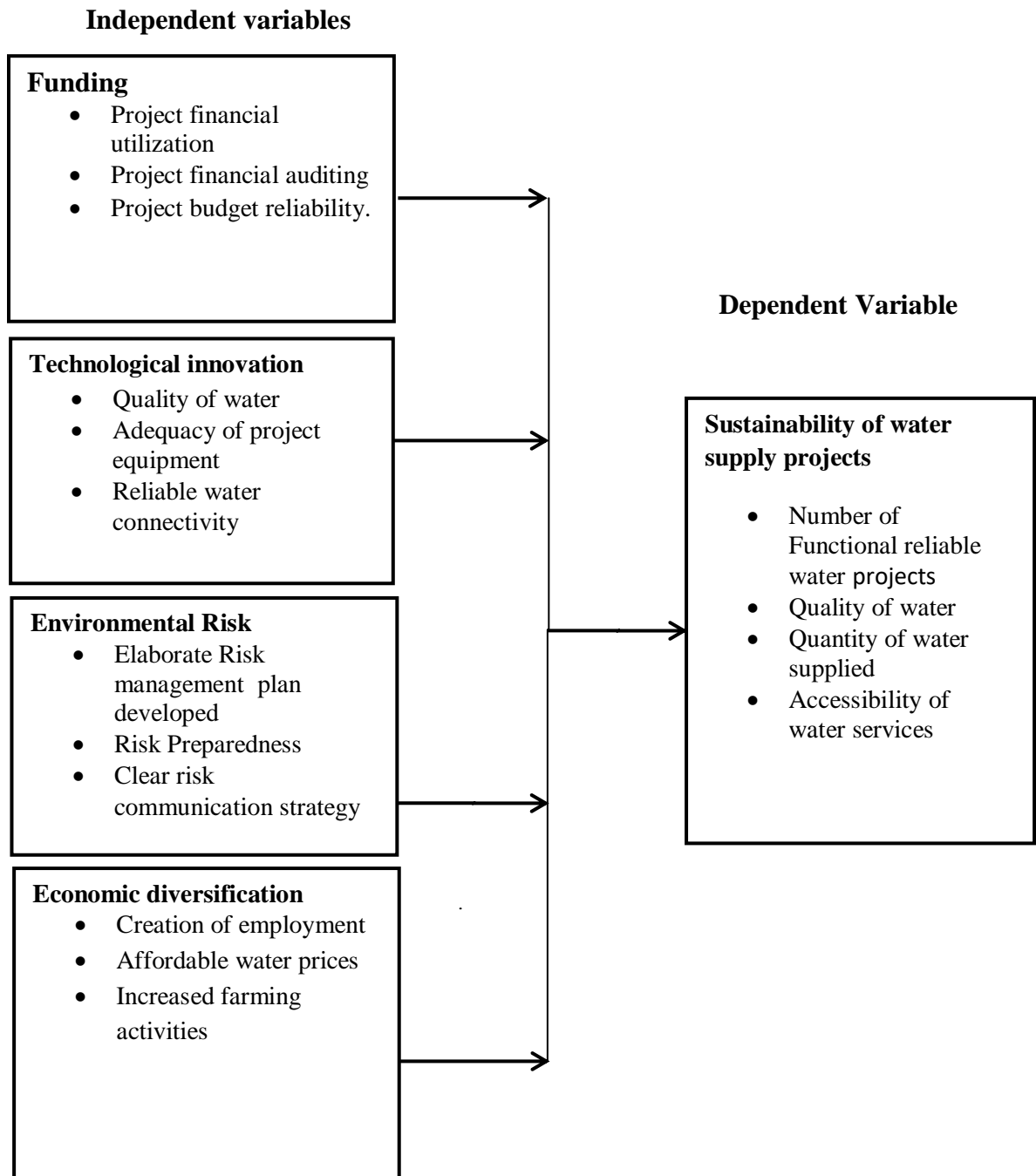


Figure 2.1: Conceptual Framework

2.11 Summary of the Literature Review

The literature review in this section has touched on studies on public private partnership on sustainability of water supply project in KIWASCO and globally. The first section dealt with public private partnerships in Kenya and globally. The second section has dealt with funding and sustainability of water supply. According to surveys done, presence of funds has a great effect on the water supply projects sustainability. This is by the assistance of NGOs and donor funding companies. The third section has dealt with the technological innovation on water supply projects sustainability in terms of technical knowhow, availability of advanced spare parts and tools to enhance efficiency in their daily activities. The fourth section dealt with environmental risk whose components were risk mitigation, preparedness and sharing. The fifth section dealt with creation of economic diversification and sustainability of water projects which entails, the low water prices, creation of employment and increased farming activities. Lastly we have, theoretical framework followed by conceptual frame work.

In a study on factors influencing rural water sustainability, the findings indicated that rural community water supply requires a capital contribution from the users, either in-kind (labor and local materials) or, if in cash, in the region of five percent of the capital cost (Biller and Andres,2014). The World Bank (WB) Group through its private sector arm, the International Finance Corporation (IFC) supports PPPs in Africa through the Sustainable Infrastructure Action Plan (SIAP) (Alexander, 2008). Procedural certainty coupled with technical assistance and political goodwill can boost infrastructure projects. Poor financial management was the primary correlate of non-functionality (Chijoriga, 2014). The reasons behind lack of financial skills are illiteracy, poor record keeping, and misappropriation of resources. There was a strong positive correlation community financial management ($r = 0.76$) and sustainability of donor funded community water supply projects supplies (Musyoka, 2003).

Approximately a third of India's hand pumps in rural water projects are either nonfunctional or in need of repairs. The GOI also trained engineers and mechanics to use

and repair these new technologies at the community level so as to enhance ownership and sustainability of community water projects (Mackenzie, 2005). The factors responsible for the non-functioning of boreholes range from extreme low yields, inability to raise funds to acquire spare parts, to lack of access to spare parts (Dacin, 2007). Water supply projects are influenced by the ease of operation and availability of spare parts for the technology incorporated in the water systems. sustainability of various types of water supply infrastructure is dependent upon the degree to which the technology used corresponds to the needs of the local community and the community's ability to maintain and repair it over time (Gleitsmann, 2005).

Population growth will have a large effect on urban water shortage in public private partnerships geared towards water supply sustainability (Biousse, 2014). Population growth and climate change together pose a significant challenge for urban water managers, but one that can be foreseen and planned for well in advance (Brikke et al, 2003). Acute water shortage (absolute scarcity), declining quality and poor sanitation has been an enigma in Kisumu city despite its proximity to the second largest fresh water lake in the world, Lake Victoria. Acute water shortage (absolute scarcity), declining quality and poor sanitation has been an enigma in Kisumu city despite its proximity to the second largest fresh water lake in the world, Lake Victoria. Weak implementation of by-laws, societal attitude, corruption, outdated technology, a poor financial base and managerial skills have been cited as some of the causes (Wright, 2006).

Diversification of income sources varies before and after the implementation of a water supply project among the water users and other beneficiaries due to the public private partnership (Bakalian, 2005). Per capita water use has been steadily declining since the 1980s while the distribution of water withdrawals between sectors has remained relatively steady (Nkeri, 2014). There is a great gap between the supply capacity and the demand. The company is therefore forced to rationing supply system in some areas. This has led to less creation of economic diversification brought about by Nairobi Waters and Sewerage Company (World Bank, 2006).

2.12 Knowledge Gaps

This study covers the gap on influence of public-private partnership on sustainability of water supply projects, Kenya: a case of KIWASCO in Kisumu. However there are always aspects of climate and environmental changes affecting water sustainability in KIWASCO. The research gap in this study suggestion should be influence of public private partnership on environmental management in Kenya: a case of KIWASCO in Kisumu.

Through the literature review the study has gathered many contextual, empirical, and conceptual study gaps that have remained exposed and which will hopefully be filled through the proposed study.

Contextual gaps are identified in that most studies on the subject at hand such as Kilewo and Frumence (2015), Dulani (2003), Soyoung and Sungchan (2014) and Manase (2016) are international in nature and very few local studies could be identified. As such, embarking on the proposed study will help in attempting to fill the contextual gap.

Conceptual gaps exist in that most studies have considered a narrow view of sustainability of water supply projects such as community ownership alone. The narrow approach in the sustainability of water supply projects is evident in the studies by among others Daib (2014), Mwangi (2008 and Obare (2014). The study at hand will attempt to fill this gap by embracing a broad concept of public private partnership in the sustainability of water projects throughout the project's life cycle.

Empirical gaps are vivid in that most of the studies reviewed embraced a narrow framework of variables and have sidelined some key variables such as environmental risks and economic diversification despite their obvious weight to the subject at hand. Studies failing in presenting the gap include Kilewo and Frumence (2015), Omolo, 2010), Mosse (2001), Adundo (2014) as well as Nyaguthii and Oyugi (2013). The study at hand is designed and structured in a manner that will attempt to methodically address these gaps.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodology that was used to conduct the study. This includes the research design, target population, sample size and sampling techniques, instruments, data collection procedure and data analysis techniques, ethical considerations and operationalization of the variables.

3.2 Research Design

The research design adopted for this study is a descriptive survey research design which sought to determine the influence of public private partnership on sustainability of water supply project. Burns and Grove (2003) define a research design as a blueprint for conducting a study with maximum control over factors that may interfere with the validity of the findings. Parahoo (1997) describes a research design as “a plan that describes how, when and where data are to be collected and analysed. Polit et al (2001) define a research design as the researcher’s overall for answering the research question or testing the research hypothesis.

The goal of survey is to derive a comparable data across subsets of chosen sample so that the similarities and differences can be determined (Cooper and Schindler, 2006). The importance of this research design is that it is the most suitable as it takes a one time snapshot of what is happening across the different governmental agencies (Trochim, 2006). Descriptive survey research is considered most appropriate because subjects are normally observed in their natural set up and can result in accurate and reliable information (Britt, 2006).The research does not aim at creating relationships between variables or manipulating the variables (Cherry, 2013).

A descriptive survey research design is used when the problem is well defined and the researcher knows something about the problem. The descriptive survey research aims at describing phenomena or narrating how various behaviors and events occur and the

researcher has no control over the variables but can only report what is happening or what has already happened.

The limitation of a descriptive survey research design is that participants or subjects may not be truthful or may not behave naturally when they know they are being observed. Similarly descriptive survey research cannot be used to correlate variables or determine cause effect.

3.3 Target Population

The target population only consisted of KIWASCO registered water users and its officials as the Key informants in the management of the company. There are a total number of approximately 75,000 KIWASCO registered water users and approximately 30 KIWASCO officials as per the information provided by KIWASCO human resource department. According to (Mugenda and Mugenda, 2003), a target population is that population which the researcher needs in order to be able to generalize results. In total the study targeted 75,030 people in total.

3.4 Sample Size and Sampling Procedures

This study was guided by simple random sampling and purposive sampling as explained in 3.4.1 and 3.4.2. Sampling in research is selecting a portion of a population to which one wants to generalize the findings to a wider population (Orodho, 2003). The purpose of sampling is to ensure a representative group which enabled the study to gain information about the whole population. The procedure for sampling should ensure that all the members of the population are given an equal chance to participate in the study, while the sample size should be statistically representative of the population where the research was conducted.

In an ideal situation, data should be collected from whole target population of 75,000 users of water and 30 KIWASCO officials. 75,000 users sample size (382) was determined by the use of Krejcie and Morgan table. But since this population is too large and scattered, the researcher did sampling to get the suitable representatives in data collection. The researcher used simple random sampling for KIWASCO water users to

avoid biasness.30 KIWASCO officials sample size was determined by employing 30% of the target officials. A sample size, 10-30% of the target population is large enough so long as it allows for reliable data analysis by cross tabulation, provides desired level of accuracy (Mugenda and Mugenda, 2003). Purposive sampling was employed in determining the key officials for the study. According to Oso and Onen (2008), purposive sampling is a technique whereby the researcher consciously decides who to include in the sample.

3.4.1 Sample Size

The sample is the individuals or group of persons who actually participates in the study and considered to be a full representation of the general population. A large sample has always been recommended as it is likely to give more accurate and representative information to the general population compared to a small sample size. To estimate the sample size of KIWASCO users, the researcher used Krejcie and Morgan’s table (1970) to arrive at the sample size. In estimation of 30 KIWASCO officials sample size, it was determined by employing 30% of the target officials. A sample size, 10-30% of the target population is large enough so long as it allows for reliable data analysis by cross tabulation, provides desired level of accuracy ((Mugenda and Mugenda, 2003). The sample was based on the target population of approximately 75,000 registered water users and 30 KIWASCO officials. Using this information, the sample size above; $75,000 = 382$ and $30 = 10$, therefore, the desired sample size for this study was 392 people which were selected from the target population of 75,030 to represent the whole population.

Table 3.1: KIWASCO Officials

KIWASCO officials	Target population	Formula	Sample size
Top management	5	30% of 5	2
Middle management	10	30% of 10	3
Subordinate staff	15	30% of 15	5
Total	30	30% of 30	10

Table 3.2: Target and Sample Population

Respondent	Target population	Sample population
Water users	75,000	382
KIWASCO officials	30	10
Total	75,030	392

3.4.2 Sampling Procedure

The sampling procedures used were simple random and purposive sampling. This is a sampling procedure in which the elements in the population are picked randomly (Kothari, 2004). A random sample was selected from 75,000 KIWASCO registered water users. The sample size for registered KIWASCO water users was 382 persons. Sampling of individuals for the study was done in such a way that the individuals selected represent the large population from which they were selected.

The researcher selected 10 KIWASCO officials as key informant interviewees through purposive sampling. This method ensured that the researcher select respondents with the required information regarding public private partnership and sustainability of water supply projects.

3.5 Research Instruments

This study was guided by use of one set of close-ended assisted questionnaires to collect data from people considered to be registered users of KIWASCO water. The questionnaire was structured into five sections, designed based on the objectives of the study, the first section sought general information on the demographic characteristics of the respondents, the second section solicited information on funding of water projects, and the third section addressed the influence of technological innovation on water supply projects. The fourth section sought information on the influence of environmental risk on sustainability water supply projects. The fifth section sought information on the influence of economic diversification. According to Mugenda and Mugenda (2003), questionnaires allow measurements for or against a particular view point at the same time it collects large amount of information in a reasonable quick space of time. The questionnaire will basically generate quantitative and qualitative data. For this study, questionnaire was

preferred as it is considered to be the most confidential and hence enhance reliability due to the absence of interviewer bias.

3.5.1 Pilot Testing for the Instruments

A pilot test is a preliminary study conducted before the final study begins to ensure that the research instrument is appropriate in answering the research questions. A pilot study was conducted in Kakamega County, which is a neighboring County and in the same region with similar water supply project as Kisumu County. This was done immediately after training the research assistant and it will involve 10 participants. Questionnaires were then administered to this group and research assistant took the respondents through the questionnaire to ensure that they understand how to respond to the questionnaires. Respondents were then given a free hand to respond to the questionnaires; blank spaces, inconsistencies, inaccurate responses and other weaknesses detected in the items was reviewed and re-testing done. Data collected was then analyzed and results used for appropriate amendment of the instrument. Important questions which had been omitted and seemed necessary were incorporated and the unclear sections were rectified. This enabled the research team to capture important comments and suggestions from the respondents that was used to improve the efficiency of the instrument.

3.5.2 Validity of the Instruments

The content validity of the instruments was determined in two ways. First, the researcher discussed the items in the instrument with the supervisors and lecturers from the department. These people was expected to indicate by tick or cross for every item in the questionnaire if it measures what it was supposed to measure or not (Creswell, 2014). Advice was given by these people to help the researcher to determine the validity of the research instruments. The advice included suggestions, clarifications and other inputs. These suggestions were used in making necessary changes.

Secondly, content validity of the instrument was determined through piloting, where the responses of the subjects were checked against the research objectives. This gave a reason as to why the content was used (Yin, 2013). For a research instrument to be

considered valid, the content selected and included in the questionnaire and interview must be relevant to the variable being investigated.

Validity is quality attributed to proposition or measures to the degree to which they conform to establish knowledge or truth (Appa and Mathirajan, 2006). An attitude scale is considered valid, for example, to the degree to which its results conform to other measures of possession of the attitude. Validity therefore refers to the extent to which an instrument can measure what it ought to measure. It therefore refers to the extent to which an instrument asks the right questions in terms of accuracy. Validity is the accuracy and meaningfulness of inferences, which are based on research results (Mugenda and Mugenda, 2009).

3.5.3 Reliability of the Instrument

The reliability of an instrument is the measure of the degree to which a research instrument yields consistent results or data after repeated trials. (Mugenda and Mugenda (2003). To ensure reliability therefore, the researcher took the instrument through a test retest method as outlined in section 3.5.1 above before utilization. This gave the research team a chance to determine how reliable the tool was in capturing the desired information. In an attempt to enhance internal reliability, questions that answer to the same objective were grouped together in sections were used to guide the respondents when filling the instruments. The questionnaires and interviews were administered twice within an interval of two weeks. This established the extent to which the questionnaire elicits the same responses every time it was administered. The results obtained from the pilot study was assisted the researcher in revising the questionnaire to make sure it covers the objectives of the study.

3.6 Data Collection Procedure

The researcher obtained an introductory letter from the University to be used in the field during data collection. The study began by obtaining research authorization and a research permit from the National Council of Science and Technology (NACOSTI) to facilitate the processing of research permit. Copies of the approval letter and permit were then presented to the County commissioner and County director of Education. The

County Commissioner then wrote an introductory letter to the Sub county commissioner who then introduced the researcher to the area chiefs. Recruitment and training of a research-assistant was also done to help with data collection and processing. Research assistant was trained on data confidentiality and other research ethics. Pilot testing was done to make the instrument clearer in preparation for actual data collection after which, the researcher administered the questionnaires to the respondents with the help of the research assistant after seeking consent with them. During the time of distributing the instrument, the researcher explained to the respondents the purpose of the study and ethical issues involved. The researcher also explained the items that may pose a challenge to the respondents and those areas that they may not understand. This helped the respondents' response to give an insight to his feelings, background, hidden motivation, interests and decisions and give as much information as possible without holding back (Mayring, 2007).

3.7 Data Analysis Techniques

The questionnaire was edited with aim of checking on completeness, consistency and clarity in answering research questions. The collected data was accumulated, categorized, coded and analyzed keeping in mind the objectives of the study. The analysis of quantitative data was done with the help of the statistical tool, Statistical Package for Social Science (SPSS) to generate a descriptive picture of the data gathered. Analysis was guided by the research objectives. A multiple regression analysis model of $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon$ was conducted to test the influence among predictor variables. Both descriptive statistics and inferential statistics were computed and the study findings were presented in frequency distribution tables, mean values, percentages, similarly interpretations were also made where applicable based on statistical generalization.

3.8 Ethical Considerations

The ethical consideration in this study is professionalism. The study was conducted only upon approval by the faculty following successful defense of the project and any appendices thereof. A permit and research authorization letter was then obtained from the National Council of Science and Technology. A copy was made to the County

Commissioner) and the County Director of Education who confirmed the authorization. A letter of introduction was given from the County Commissioner to the Sub County Commissioner who then introduced the researcher to the area Chiefs.

Privacy and confidentiality of the respondents' information was another major ethical issue in the study. There were proper considerations to enhance privacy of the participants. The research did not attempt to know or reveal personal information relating to the participants as a measure to prevent possible discrimination or abuse resulting from their contribution to the study. An assurance was therefore given to the participants on confidentiality of their information and anonymous questionnaires were used to ensure that information collected remain confidential. Respondents were given a chance to choose if to participate in the study or not. The participants also voluntarily took part in the research, and were asked not to openly reveal their names and contact(s) or such information relating to their privacy.

3.9 Operationalization of Variables

The Variables were operationalized as shown in the table

Objectives	Type of variable	Indicators	Scale	Tool of Analysis	Types of analysis
To establish how funding influence sustainability of water supply projects in Kisumu County	Independent: Funding Dependent: Sustainability of water supply	Project financial Utilization Project financial auditing Project budget reliability	Nominal	Mean, Standard Deviation & regression	Descriptive/Inferential
To assess how technological innovation influence sustainability of water supply projects in Kisumu County	Independent: Application of technological innovation Dependent: Sustainability of water supply	Quality of water Adequacy of project equipment Reliable Water connectivity	Nominal	Mean, Standard Deviation & regression	Descriptive/Inferential
To assess how environmental risks influence sustainability of water supply projects in Kisumu County	Independent: Environmental risks Dependent: Sustainability of water supply	-Elaborate risk management plan -Risk preparedness -Clear risk communication strategy	Nominal	Mean, Standard Deviation & regression	Descriptive/Inferential
To determine how creation of economic diversification influence sustainability of water supply projects in Kisumu County	Independent: Creation of economic diversification Dependent: Sustainability of water supply	Creation of employment Reduced water prices Increased farming activities	Nominal	Mean, Standard Deviation & regression	Descriptive/Inferential

Table 3.3: Operational Definition of Variables

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents and interprets analyzed data generated from the study public private partnerships on sustainability of water supply projects. Data is organized around the study objectives and is presented in two parts; data presentation, analysis and interpretation.

The subheadings in this chapter were arranged according to research objectives: To establish how funding influence sustainability of water supply projects in Kisumu County, Kenya: To assess how technological innovation influence sustainability of water supply projects in Kisumu County, Kenya: To assess how environmental risk influence sustainability of water supply projects in Kisumu County, Kenya: To determine how economic diversification influence sustainability of water supply projects in Kisumu County, Kenya.

The study findings have been presented in frequency distribution tables, mean values, percentages and explanations of the findings in between the frequency tables for further elaboration as well as the interpretation of the study results which have been given alongside the findings.

4.2 Questionnaire Return Rate

A total of 382 questionnaires were issued to registered KIWASCO water users and 300 were returned. Thus the return rate was 78.5% for the registered KIWASCO water users. This response rate can be attributed to the fact that the researcher with his research assistant personally administered the research instrument. According to Coopers and Schindler (2000-2005) questionnaire return rate of 75% is appropriate for social science studies.

4.2 Demographic Information of the Respondents

The study sought to determine the demographic characteristics of the respondents as they are considered as categorical variables which give some basic insight about the respondents. The characteristics considered in the study were; ages of the respondents; gender; highest level of education attained and period the respondents had benefitted from KIWASCO water.

4.2:1 Distribution of Respondents by their Gender

It was important to know if both genders benefited from KIWASCO water project. The respondents were asked to indicate their gender and the results are indicated in table 4.1

Table 4.1: Distribution of Respondents by their Gender

Gender	Frequency	Percent
Female	180	60.00
Male	120	40.00
Total	300	100.00

Table 4.1 shows that out of 300 respondents who participated in the study, 180 (60%) of the respondents were female while 120 (40%) of the respondents were male. The findings indicate that more female than male benefited from the KIWASCO project. This confirms the notion that women are more involved in availability of water in households and therefore this attests to their importance in the sustainability of water supply projects.

4.2:2 Distributions of Respondents by Age

The study was also interested in establishing the age of the respondents because people at younger age are believed to consume more water than at advanced age and therefore respondents were asked to indicate the age brackets they belong to. Results are shown in table 4.2

Table 4.2: Distribution of Respondents by Age

Age Brackets	Frequency	Percent
18-30 years	37	12.33
31-40 years	133	44.33
41-55 years	87	29.00
Above 55 years	43	14.33
Total	300	100.00

Table 4.2 shows that out of 300 respondents who participated in the study, 37 (12.33%) were aged between 18-30 years, 133 (44.33%) of the respondents were aged between 31-40 years, 87 (29.00%) of the respondents were aged between 41-55 years. Those aged above 55 years were 43 (14.33%). This results imply that the younger people who fall in the age bracket of 18-40 years are the majority with 170(56.66%) and therefore given the high consumption needed there is need for sustainability of the water supply to ensure consistency in consumption.

4.2.3 Distribution of Respondents by Level of Education

The study was interested in understanding the level of education of the respondents. This is because level of education determines the economic power resulting from employment hence the power to pay for water supply and that may influence sustainability of water supply projects. The respondents were asked to indicate their level of education and the results are shown in table 4.3.

Table 4.3: Highest Level of Educational

Level of Education	Frequency	Percent
Primary	14	4.67
Secondary	192	64.00
Tertiary	94	31.33
Total	300	100.00

Table 4.3 shows that out of 300 respondents who participated in the study, 14 (4.67%) had reached primary, 192 (64.00%) of the respondents had attained secondary education,

94 (31.33%) had attained tertiary education. This shows that most KIWASCO water users are able to pay for water supply.

4.2.4 Distribution of Respondents by Period of Water Supply from KIWASCO

The study was also interested in understanding for how long the respondents have been served by KIWASCO water supply. This is because period of water supply would help determine consistency of water supply and that may influence sustainability of water supply projects. The respondents were asked to indicate the period the period of water supply from KIWASCO and the results are shown in table 4.4.

Table 4.4: Period the Respondents have benefited from water supply from KIWASCO

Period of water supply	Frequency	Percent
0 - 11 months	6	2.00
1 -3 years	214	71.33
3 -5 years	68	22.67
More than 5 years	12	4.00
Total	300	100.00

Table 4.4 shows that out of 300 respondents who participated in the study 6(2%) of the respondents had benefited from KIWASCO water for 0-11 months, 214 (71.33%) of the respondents had benefited from KIWASCO water for 1 -3 years, 68 (22.67%) of the respondents had benefited from KIWASCO water for 3 -5 years, 12 (4.00%) of the respondents had benefited from KIWASCO water for more than 5 years. and 6 (2.00%) of the respondents had benefited from KIWASCO water for 0 -11 months. This implies that KIWASCO water project has been in consistent supply of water to their consumers between 1-5 years which is an indicator of reliability and continuation of being in business.

4.3 Funding and Sustainability of Water Supply Projects

The first objective that the study was set to achieve was to find out the extent to which the respondents agreed that funding influences sustainability of water supply projects in Kisumu county Kenya. To achieve this, the respondents were asked to give their opinion on the extent to which they supported the statements in a likert scale of 1-5 where; 1 = Not at all, 2 = Little extent, 3 = Moderate extent, 4 = Great extent, 5 = Very great extent. The results are presented in table 4.5

Table 4.5: Relationship between Funding and Sustainability of Water Supply Projects

Statement	Not at all		Little extent		Moderate extent		Great extent		Very great extent		Mean	Std dev
	F	%	F	%	F	%	F	%	F	%		
Project financial utilization schedules influence sustainability of water supply projects	20	6.67	25	8.33		11.67	120	40.00	100	33.33	3.85	0.25
Budget reliability influence sustainability of water projects	2	0.67	9	3.00	40	13.33	142	47.33	107	35.67	4.14	0.13
Project financial auditing influence sustainability of water projects positively	3	1.00	3	1.00	20	6.67	104	34.67	170	56.67	4.45	0.19
Composite Mean and Standard Deviation											4.15	0.19

On whether project financial utilization influences sustainability of water supply projects, out of 300 respondents who participated in the study 20(6.67%) said not at all, 25(8.33%) said to a little extent, 35(11.67%) said moderate extent, 120(40%) said to a great extent and 100(33.33%) said to a very great extent. This constituted a mean of 3.85 which is less than the composite mean and a standard deviation of 0.25 which is greater than the

composite standard deviation. The composite mean is greater than the mean of project financial utilization. This implies that project financial utilization does not influence the sustainability of water supply projects.

On whether project budget reliability influences sustainability of water supply projects, out of 300 respondents who participated in the study 2(0.67%) said not at all, 9(3.00%) said to a little extent, 40(13.33%) said moderate extent, 142(47.33%) said to a great extent and 107(35.67%) said to a very great extent. This constituted a mean of 4.14 which is less than the composite mean and a standard deviation of 0.13 which is less than the composite standard deviation. The composite mean is greater than the mean of project budget reliability. This implies that project budget reliability does not influence the sustainability of water supply projects.

On whether project financial auditing influences sustainability of water supply projects, out of 300 respondents who participated in the study 3(1.00%) said not at all, 3(1.00%) said to a little extent, 20(6.67%) said moderate extent, 104(34.67%) said to a great extent and 170(56.67%) said to a very great extent. This constituted a mean of 4.45 which is greater than the composite mean and a standard deviation of 0.19 which is equal to the composite standard deviation. The composite mean is less than the mean of project financial auditing. This implies that project financial auditing influences the sustainability of water supply projects.

The first objective of the study was also set to establish how funding influence sustainability of water supply projects in Kisumu county Kenya. To achieve this, the respondents were asked to give their opinion on their level of agreement or disagreement with the statements in a Likert scale of 1-5 where; 1 = strongly disagree, 2 = disagree, 3 = Not Sure, 4 = Agree, 5 = strongly agree. The findings were presented in Table 4.6.

Table 4.6: Funding and Sustainability of Water Supply Projects

Statement	Strongly Disagree		Disagree		Not Sure		Agree		Strongly Agree		Mean	Std dev
	F	%	F	%	F	%	F	%	F	%		
Project financial utilization schedules influence sustainability of water supply projects	4	1.33	6	2.00	14	4.67	68	22.67	208	69.33	4.57	0.15
Budget reliability influence sustainability of water projects	9	3.00	23	7.67	8	2.67	60	20.00	200	66.67	4.40	0.26
Project financial auditing influence sustainability of water projects positively	2	0.67	3	1.00	15	5.00	50	16.67	230	76.67	4.68	0.32
Composite Mean and Composite Standard Deviation											4.55	0.24

The results in table 4.6 as interpreted as follows;

On whether Project financial utilization schedules influence sustainability of water supply projects, out of 300 respondents who participated in the study 4(1.33%) strongly disagreed, 6(2.00%) disagreed, 14(4.67%) were not sure, 68(22.67%) agreed and 208(69.33%) strongly agreed. This constituted a mean of 4.57 which is greater than the composite mean and a standard deviation of 0.15 which is less than the composite standard deviation. The composite mean is less than the mean of project budget reliability. This implies that project budget reliability influence the sustainability of water supply projects.

On whether Project budget reliability influence sustainability of water supply projects, out of 300 respondents who participated in the study 9(3.00%) strongly disagreed, 23(7.67%) disagreed, 8(2.67%) were not sure, 60(20.00%) agreed and 200(66.67%) strongly agreed. This constituted a mean of 4.40 which is less than the composite mean

and a standard deviation of 0.26 which is greater than the composite standard deviation. The composite mean is greater than the mean of project budget reliability. This implies that project budget reliability does not influence sustainability of water supply projects.

On whether Project financial auditing influence sustainability of water supply projects, out of 300 respondents who participated in the study 2(0.67%) strongly disagreed, 3(1.00%) disagreed, 15(5.00%) were not sure, 50(16.67%) agreed and 230(76.67%) strongly agreed. This constituted a mean of 4.68 which is greater than the composite mean and a standard deviation of 0.32 which is greater than the composite standard deviation. The composite mean is less than the mean of project financial auditing. This implies that project financial auditing influence sustainability of water supply projects.

4.4 Technological Innovation and Sustainability of Water Supply Projects

The second objective that the study was set to achieve was to find out the extent to which the respondents agreed that technological innovation influences sustainability of water supply projects in Kisumu County Kenya. To achieve this, the respondents were asked to give their opinion on the extent to which they supported the statements in a likert scale of 1-5 where; 1 = Not at all, 2 = Little extent, 3 = Moderate extent, 4 = Great extent, 5 = Very great extent. The results are presented in table 4.7

Table 4.7: Relationship between Technological Innovation and Sustainability of Water Supply Project

Statement	1		2		3		4		5		Mean	Std dev
	F	%	F	%	F	%	F	%	F	%		
Quality of water influence sustainability of water supply projects	20	6.67	25	8.33	43	14.33	92	30.67	120	40.00	3.89	0.52
Adequacy of project equipment influence sustainability of water supply projects	6	2.00	20	6.67	50	16.67	89	29.67	135	45.00	4.09	0.17
Reliable water connectivity influence sustainability of water supply projects	3	1.00	18	6.00	62	20.67	100	33.33	117	39.00	4.03	0.12
Composite Mean and Composite Standard Deviation											4.00	0.27

On whether quality of water influences sustainability of water supply projects, out of 300 respondents who participated in the study 20(6.67%) said not at all, 25(8.33%) said to a little extent, 43(14.33%) said moderate extent, 92(30.67%) said to a great extent and 120(40.00%) said to a very great extent. This constituted a mean of 3.89 which is less than the composite mean and a standard deviation of 0.52 which is greater than the composite standard deviation. The composite mean is greater than the mean of quality of water. This implies that quality of water does not influence the sustainability of water supply projects.

On whether adequacy of project equipment influence sustainability of water supply projects, out of 300 respondents who participated in the study 6(2.00%) said not at all, 20(6.67%) said to a little extent, 50(16.67%) said moderate extent, 89(29.67%) said to a great extent and 135(45.00%) said to a very great extent. This constituted a mean of 4.09 which is greater than the composite mean and a standard deviation of 0.17 which is less than the composite standard deviation. The composite mean is greater than the mean of adequacy of project equipment. This implies that adequacy of project equipment influence the sustainability of water supply projects.

On whether reliable water connectivity influence sustainability of water supply projects, out of 300 respondents who participated in the study 3(1.00%) said not at all, 18(6.00%) said to a little extent, 62(20.67%) said moderate extent, 100(33.33%) said to a great extent and 117(39.00%) said to a very great extent. This constituted a mean of 4.03 which is greater than the composite mean and a standard deviation of 0.12 which is less than the composite standard deviation. The composite mean is less than the mean of reliable water connectivity. This implies that reliable water connectivity influence the sustainability of water supply projects.

The Second objective of the study was also set to establish how technological innovation influence sustainability of water supply projects in Kisumu county Kenya. To achieve this, the respondents were asked to give their opinion on their level of agreement or disagreement with the statements in a Likert scale of 1-5 where; 1 = strongly disagree, 2 = disagree, 3 = Not Sure, 4 = Agree, 5 = strongly agree. The findings were presented in Table 4.8.

Table 4.8: Technological Innovation and Sustainability of Water Supply Project

Statement	1		2		3		4		5		Mean	Std dev
	F	%	F	%	F	%	F	%	F	%		
Quality of water influence sustainability of water supply projects	2	0.67	4	1.33	16	5.33	100	33.33	178	59.33	4.49	0.14
Adequacy of project equipment influence sustainability of water supply projects	5	1.67	10	3.33	10	3.33	95	31.67	180	60.00	4.45	0.25
Reliable water connectivity influence sustainability of water supply projects	2	0.67	3	1.00	8	2.67	120	40.00	167	55.67	4.49	0.19
Composite Mean and Composite Standard Deviation											4.48	0.19

The results in table 4.8 as interpreted as follows;

On whether quality of water influence sustainability of water supply projects, out of 300 respondents who participated in the study 2(0.67%) strongly disagreed, 4(1.33%) disagreed, 16(5.33%) were not sure, 100(33.33%) agreed and 178(59.33%) strongly agreed. This constituted a mean of 4.49 which is greater than the composite mean and a standard deviation of 0.14 which is less than the composite standard deviation. The composite mean is less than the mean of quality of water. This implies that quality of water influence the sustainability of water supply projects.

On whether adequacy of project equipment influence sustainability of water supply projects, out of 300 respondents who participated in the study 5(1.67%) strongly disagreed, 10(3.33%) disagreed, 10(3.33%) were not sure, 95(31.67%) agreed and 180(60.00%) strongly agreed. This constituted a mean of 4.45 which is less than the composite mean and a standard deviation of 0.25 which is greater than the composite

standard deviation. The composite mean is greater than the mean of adequacy of project equipment. This implies that adequacy of project equipment does not influence sustainability of water supply projects.

On whether reliable water connectivity influence sustainability of water supply projects, out of 300 respondents who participated in the study 2(0.67%) strongly disagreed, 3(1.00%) disagreed, 8(2.67%) were not sure, 120(40.00%) agreed and 167(55.67%) strongly agreed. This constituted a mean of 4.49 which is greater than the composite mean and a standard deviation of 0.19 which is equal to the composite standard deviation. From the study findings the composite mean is less than the mean of reliable water connectivity. This implies that reliable water connectivity influence sustainability of water supply projects.

4.5 Environmental Risks and Sustainability of Water Supply Projects

The third objective that the study was set to achieve was to find out the extent to which the respondents agreed that environmental risk influence sustainability of water supply projects in Kisumu County Kenya. To achieve this, the respondents were asked to give their opinion on the extent to which they supported the statements in a likert scale of 1-5 where; 1 = Not at all, 2 = Little extent, 3 = Moderate extent, 4 = Great extent, 5 = Very great extent. The results are presented in table 4.9

Table 4.9: Relationship between Environmental Risk and Sustainability of Water Supply Projects

Statement	1		2		3		4		5		Mean	Std dev
	F	%	F	%	F	%	F	%	F	%		
Elaborate risk management plan influences sustainability of water supply projects	4	1.33	10	3.33	20	6.67	170	56.67	96	32.00	4.15	0.27
Risk preparedness influences sustainability of water supply projects	5	1.67	20	6.67	38	12.67	158	52.67	79	26.33	3.95	0.35
Clear risk communication influences sustainability of water supply projects	10	3.33	15	5.00	40	13.33	150	50.00	85	28.33	3.95	0.21
Composite Mean and Composite Standard Deviation											4.02	0.28

On whether elaborate risk management plan influences sustainability of water supply projects, out of 300 respondents who participated in the study 4(1.33%) said not at all, 10(3.33%) said to a little extent, 20(6.67%) said moderate extent, 170(56.67%) said to a great extent and 96(32.00%) said to a very great extent. This constituted a mean of 4.15 which is more than the composite mean and a standard deviation of 0.27 which is less than the composite standard deviation. According to the findings the composite mean is less than the mean of elaborate risk management plan. This implies that elaborate risk management plan influence the sustainability of water supply projects.

On whether risk preparedness influence sustainability of water supply projects, out of 300 respondents who participated in the study 5(1.67%) said not at all, 20(6.67%) said to a little extent, 38(12.67%) said moderate extent, 158(52.67%) said to a great extent and 79(26.33%) said to a very great extent. This constituted a mean of 3.95 which is less than the composite mean and a standard deviation of 0.35 which is greater than the composite standard deviation. From the findings of the study the composite mean is greater than the mean of risk preparedness. This implies that risk preparedness does not influence the sustainability of water supply projects.

On whether clear risk communication influence sustainability of water supply projects, out of 300 respondents who participated in the study 10(3.33%) said not at all, 15(5.00%) said to a little extent, 40(13.33%) said moderate extent, 150(50.00%) said to a great extent and 85(28.33%) said to a very great extent. This constituted a mean of 3.95 which is less than the composite mean and a standard deviation of 0.21 which is less than the composite standard deviation. The study findings show that the composite mean is greater than the mean of clear risk communication. This implies that clear risk communication does not influence the sustainability of water supply projects.

The third objective of the study was also set to establish how environmental risk influence sustainability of water supply projects in Kisumu county Kenya. To achieve this, the respondents were asked to give their opinion on their level of agreement or disagreement with the statements in a Likert scale of 1-5 where; 1 = strongly disagree, 2 = disagree, 3 = Not Sure, 4 = Agree, 5 = strongly agree. The findings were presented in Table 4.10.

Table 4.10: Environmental Risk and Sustainability of Water Supply Projects

Statement	Strongly Disagree		Disagree		Not Sure		Agree		Strongly Agree		Mean	Std dev
	F	%	F	%	F	%	F	%	F	%		
Elaborate risk management plans influence sustainability of water supply projects	3	1.00	10	3.33	37	12.33	150	50.00	100	33.33	4.11	0.27
Risk preparedness influence sustainability of water supply projects	5	1.67	15	5.00	30	10.00	170	56.67	80	26.67	4.02	0.18
Clear risk communication influence sustainability of water supply projects	11	3.67	19	6.33	50	16.67	120	40.00	100	33.33	3.93	0.28
Composite mean and Composite Standard Deviation											4.02	0.24

The results in table 4.10 as interpreted as follows;

On whether elaborate risk management plan influence sustainability of water supply projects, out of 300 respondents who participated in the study 3(1.00%) strongly disagreed, 10(3.33%) disagreed, 37(12.33%) were not sure, 150(50.00%) agreed and 100(33.33%) strongly agreed. This constituted a mean of 4.11 which is greater than the composite mean and a standard deviation of 0.27 which is greater than the composite standard deviation. Study findings show that the composite mean is less than the mean of elaborate risk management plan. This implies that elaborate risk management plan influence the sustainability of water supply projects.

On whether risk preparedness influence sustainability of water supply projects, out of 300 respondents who participated in the study 5(1.67%) strongly disagreed, 15(5.00%) disagreed, 30(10.00%) were not sure, 170(56.67%) agreed and 80(26.67%) strongly agreed. This constituted a mean of 4.02 which is equal to the composite mean and a

standard deviation of 0.18 which is less than the composite standard deviation. From the study findings the composite mean is equal to the mean of risk preparedness. This implies that risk preparedness does not influence sustainability of water supply projects.

On whether clear risk communication influence sustainability of water supply projects, out of 300 respondents who participated in the study 11(3.67%) strongly disagreed, 19(6.33%) disagreed, 50(16.67%) were not sure, 120(40.00%) agreed and 100(33.33%) strongly agreed. This constituted a mean of 3.93 which is less than the composite mean and a standard deviation of 0.28 which is greater than the composite standard deviation. The study findings show that the composite mean is greater than the mean of clear risk communication. This implies that clear risk communication does not influence sustainability of water supply projects.

4.6 Creation of Economic Diversification and Sustainability of Water Supply Projects

The fourth objective that the study was set to achieve was to find out the extent to which the respondents agreed that economic diversification influence sustainability of water supply projects in Kisumu County Kenya. To achieve this, the respondents were asked to give their opinion on the extent to which they supported the statements in a likert scale of 1-5 where; 1 = Not at all, 2 = Little extent, 3 = Moderate extent, 4 = Great extent, 5 = Very great extent. The results are presented in table 4.11

Table 4.11: Relationship between Economic Diversification and Sustainability of Water Supply Projects

Statement	Not at all		Little extent		Moderate extent		Great extent		Very great extent		Mean	Std dev
	F	%	F	%	F	%	F	%	F	%		
Creation of employment	5	1.67	15	5.00	20	6.67	160	53.33	100	33.33	4.12	0.37
Affordable water prices	8	2.67	20	6.67	32	10.67	145	48.33	95	31.67	4.00	0.42
Increased farming activities	3	1.00	10	3.33	18	6.00	149	49.67	120	40.00	4.24	0.37
Composite Mean and Composite Standard Deviation											4.12	0.39

On whether elaborate risk management plan influences sustainability of water supply projects, out of 300 respondents who participated in the study 5(1.67%) said not at all, 15(5.00%) said to a little extent, 20(6.67%) said moderate extent, 160(53.33%) said to a great extent and 100(33.33%) said to a very great extent. This constituted a mean of 4.12 which is equal to the composite mean and a standard deviation of 0.37 which is less than the composite standard deviation. According to the findings the composite mean is equal to the mean of creation of employment. This implies that creation of employments does not influence the sustainability of water supply projects.

On whether affordable water prices influence sustainability of water supply projects, out of 300 respondents who participated in the study 8(2.67%) said not at all, 20(6.67%) said to a little extent, 32(10.67%) said moderate extent, 145(48.33%) said to a great extent and 95(31.67%) said to a very great extent. This constituted a mean of 4.00 which is less than the composite mean and a standard deviation of 0.42 which is greater than the composite standard deviation. From the findings of the study, the composite mean is greater than the mean of affordable water prices. This implies that affordable water prices do not influence the sustainability of water supply projects.

On whether increased farming activities influence sustainability of water supply projects, out of 300 respondents who participated in the study 3(1.00%) said not at all, 10(3.33%) said to a little extent, 18(6.00%) said moderate extent, 149(49.67%) said to a great extent and 120(40.00%) said to a very great extent. This constituted a mean of 4.24 which is greater than the composite mean and a standard deviation of 0.37 which is less than the composite standard deviation. The study findings show that the composite mean is less than the mean of increase farming activities. This implies that increased farming activities influence the sustainability of water supply projects.

The fourth objective of the study was also set to establish how environmental risk influence sustainability of water supply projects in Kisumu county Kenya. To achieve this, the respondents were asked to give their opinion on their level of agreement or disagreement with the statements in a Likert scale of 1-5 where; 1 = strongly disagree, 2 = disagree, 3 = Not Sure, 4 = Agree, 5 = strongly agree. The findings were presented in Table 4.12.

Table 4.12: Creation of Economic Diversification and Sustainability of Water Supply Projects

Statement	Strongly Disagree		Disagree		Not Sure		Agree		Strongly Agree		Mean	Std dev
	F	%	F	%	F	%	F	%	F	%		
Creation of employment through water supply sustainability has led to economic diversification	3	1.00	7	2.33	15	5.00	180	60.00	95	31.67	4.19	0.16
Affordable water prices has led to increased savings and investments	8	2.67	10	3.33	36	12.00	170	56.67	76	25.33	3.99	0.18
Availability of water has led to increased farming activities and improved livelihood among the water users.	4	1.33	5	1.67	47	15.67	163	54.33	81	27.00	4.04	0.26
Composite Mean and Composite Standard Deviation											4.07	0.20

The results in table 4.12 as interpreted as follows;

On whether Creation of employment through water supply sustainability has led to economic diversification hence influence sustainability of water supply projects, out of 300 respondents who participated in the study 3(1.00%) strongly disagreed, 7(2.33%) disagreed, 15(5.00%) were not sure, 180(60.00%) agreed and 95(31.67%) strongly

agreed. This constituted a mean of 4.19 which is greater than the composite mean and a standard deviation of 0.16 which is less than the composite standard deviation. Study findings show that the composite mean is less than the mean of Creation of employment through water supply sustainability. This implies that Creation of employment through water supply sustainability influence the sustainability of water supply projects.

On whether affordable water prices has led to increased savings hence influence sustainability of water supply projects, out of 300 respondents who participated in the study 8(2.67%) strongly disagreed, 10(3.33%) disagreed, 36(12.00%) were not sure, 170(56.67%) agreed and 76(25.33%) strongly agreed. This constituted a mean of 3.99 which is less than the composite mean and a standard deviation of 0.18 which is less than the composite standard deviation. The study findings show that the composite mean is greater than the mean affordable water prices. This implies that affordable water prices does not influence sustainability of water supply projects.

On whether availability of water has led to increased farming activities and improved livelihood among the water users hence influence sustainability of water supply projects, out of 300 respondents who participated in the study 4(1.33%) strongly disagreed, 5(1.67%) disagreed, 47(15.67%) were not sure, 163(54.33%) agreed and 81(27.00%) strongly agreed. This constituted a mean of 4.04 which is less than the composite mean and a standard deviation of 0.26 which is greater than the composite standard deviation. The study findings show that the composite mean is greater than the mean of availability of water which has led to increased farming activities and improved livelihood among the water users. This implies that Availability of water which has led to increased farming activities and improved livelihood among the water users does not influence sustainability of water supply projects.

4.7 Regression analysis

In this study, a multiple regression analysis was conducted to test the influence among predictor variables. The research used statistical package for social sciences (SPSS Version 21) to code, enter and compute the measurements of the multiple regressions.

Table 4.13: Multiple Regression Between Public Private Partnership and Sustainability of Water Supply Projects

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.851	.728	.694	.3042

a. Predictors: (Constant), Funding, technological innovation, environmental risk and economic diversification.

The data in Table 4.13 indicated that R-Square (coefficient of determination) is a commonly used statistic to evaluate model fit. R-square is 1 minus the ratio of residual variability. The adjusted R^2 , also called the coefficient of multiple determinations, is the percent of the variance in the dependent explained uniquely or jointly by the independent variables. 69.4% of the sustainability of water supply. Variables could be attributed to the combined effect of the predictor variables.

Table 4.14: ANOVA Results of the Regression Analysis Between Sustainability of Water Supply and Predictor Variables

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	11.423	3	3.185	3.926	.0001
	Residual	87.532	297	.721		
	Total	98.955	300			

a. Predictors: Funding, technological innovation, environmental risk and economic diversification.

b. Dependent Variable: Sustainability of water supply.

The data in Table 4.14 indicated that the probability value of 0.0001 indicates that the regression relationship was highly significant in predicting how funding, technological innovation, environmental risk and economic diversification influenced sustainability of water supply. The F critical at 5% level of significance was 3.926 since F calculated is greater than the F critical (value = 2.830), this shows that the overall model was significant.

Table 4.15: Regression Coefficients of the Relationship Between Sustainability of Water Supply and the Predictive Variables

Mode I	Unstandardized		Standardized		
	B	Std. Error	Beta	T	Sig.
1 (Constant)	2.031	0.422		4.307	0
Funding	0.729	0.093	0.597	0.054	0.0003
Technological innovation	0.846	0.085	0.689	0.615	0.0001
Environmental risk	0.704	0.087	0.575	0.436	0.004
Economic diversification	0.392	0.084	0.473	0.416	0.006

a. Dependent Variable: Sustainability of water supply

As per the SPSS generated table above, the equation ($Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon$) becomes:

$$Y = 2.031 + 0.729X_1 + 0.846 X_2 + 0.704 X_3 + 0.392 X_4$$

The regression equation in Table 4.15 has established that taking all factors into account (funding, technological innovation, environmental risk and economic diversification) constant at zero, sustainability of water supply will be 2.031. The findings presented also

show that taking all other independent variables at zero, a unit increase in technology and innovation would lead to a 0.846 increase in the sustainability of water supply.

Further, the findings shows that a unit increases in funding would lead to a 0.729 increase in sustainability of water supply. In addition, the findings show that a unit increase in environmental risk would lead to a 0.704 decrease in sustainability of water supply. Also, the findings show that a unit increase in economic diversification would lead to a 0.392 increase in sustainability of water supply. Overall, economic diversification had the least effect on sustainability of water supply and technological innovation had the highest effect.

Funding calculated p-value was found to be 0.0003 which is statistically significant ($p < 0.05$) which is level of confidence. The funding has a positive significant influence on sustainability of water supply. Technological innovation calculated P-value was found to be 0.0001 which is statistically significant since $P < 0.05$. There is a positive correlation between the sustainability of water supply. Environmental risk calculated P-value was found to be 0.004 which statistically $P < 0.05$ hence significant.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter comprises of and is organized into the following subheadings: summary of the study, discussions of the findings, conclusions of the study, recommendations of the study and suggestions for further study.

5.2 Summary of Findings

The study assessed the the influence of public private partnership on sustainability of water supply projects: case of KIWASCO, Kisumu County, Kenya by: seeking to establish how funding influence sustainability of water supply projects in Kisumu County; determine how technological innovation influence sustainability of water supply projects in Kisumu County; determine how environmental risk influence sustainability of water supply projects in Kisumu County; examine how economic diversification influence sustainability of water supply projects in Kisumu County, Kenya.

Research instruments used included one questionnaire for the KIWASCO water users and interview guide for the key informants. Data from the field was collected by the researcher and analyzed for basic descriptive statistics. The main findings of the study are:

5.2.1 Funding and Sustainability of Water Supply Projects

The study found out that project financial auditing affected sustainability of water supply to a great extent as indicated by a mean of 4.45 and standard deviation of 0.19. Project financial utilization affected sustainability of water supply to a great extent as indicated by a mean of 4.14 and standard deviation of 0.13. The respondents strongly agreed that project finanacial auditing influenced sustainability of water projects positively as indicated by a mean of 4.68 and standard deviation of 0.32. The respondents strongly agreed that budget reliability schedules improve sustainability of water supply projects as indicated by a mean of 4.57 and standard deviation of 0.15.

5.2.2 Technological Innovation and Sustainability of Water Supply Projects

The study found out that adequacy of project equipment affected sustainability of water supply to a great extent as indicated by a mean of 4.09 and standard deviation of 0.17. Reliable water connectivity affected sustainability of water supply to a great extent as indicated by a mean of 4.03 and standard deviation of 0.12. The respondents agreed that KIWASCO water connectivity is advanced and in compliance with the current technological era as indicated by a mean of 4.49 and standard deviation of 0.19. The respondents agreed that quality of water and water treatment plants are being implemented to improve sustainability of water supply as indicated by a mean of 4.49 and standard deviation of 0.14.

5.2.3 Environmental Risks and Sustainability of Water Supply Projects

The study found out that elaborate risk management plan affected sustainability of water supply to a great extent as indicated by a mean of 4.15 and standard deviation of 0.27. Risk preparedness affected sustainability of water supply to a great extent as indicated by a mean of 3.95 and standard deviation of 0.35. The respondents agreed that risk mitigation and assessment prevent hazards from happening in advance as indicated by a mean of 4.11 and standard deviation of 0.27. The respondents agreed that risk preparedness helps KIWASCO in getting ready for inevitable hazards for instance natural drought and famine as indicated by a mean of 4.02 and standard deviation of 0.18.

5.2.4 Creation of Economic Diversification and Sustainability of Water Supply Projects

The study found out that increased farming activities and self-sustenance affected sustainability of water supply to a great extent as indicated by a mean of 4.24 and standard deviation of 0.37. Creation of employment affected sustainability of water supply to a great extent as indicated by a mean of 4.12 and standard deviation of 0.37. The respondents agreed that creation of employment has led to economic diversification through water supply sustainability as indicated by a mean of 4.19 and standard deviation of 0.16. The respondents agreed that availability of water has led to increased farming

activities and improved livelihood among the water users as indicated by a mean of 4.04 and standard deviation of 0.18.

5.3 Discussion

5.3.1 Funding and Sustainability of Water Supply Projects

Project financial auditing affected sustainability of water supply projects to a great extent as indicated by a mean of 4.45 and standard deviation of 0.19. Project financial utilization improved sustainability of water supply projects as indicated by a mean of 4.40 and standard deviation of 0.26. Schneier (2006) concluded that poor financial management was the primary correlate of non-functionality. Revenue collection improved by the introduction of a private operator.

5.3.2 Technological Innovation and Sustainability of Water Supply Projects

Adequacy of project equipment affected sustainability of water supply to a great extent as indicated by a mean of 4.09 and standard deviation of 0.17. KIWASCO water connectivity is reliable, advanced and in compliance with the current technological era as indicated by a mean of 4.49 and standard deviation of 0.19. Brikke et al., (2003) who suggested the use of sustainable technology at the community level and argued that projects must incorporate selection of appropriate technology and integrate Operation and Maintenance (OandM) into project development right from the start.

5.3.3 Environmental Risk and Sustainability of Water Supply Projects

Elaborate risk management plan affected sustainability of water supply to a great extent as indicated by a mean of 4.15 and standard deviation of 0.27. Risk mitigation and assessment prevent hazards from happening in advance as indicated by a mean of 4.11 and standard deviation of 0.27. Ashgate and Lepenies (2008) concluded that it is beneficial to develop integrated approaches to evaluate, and provide scientific assessments of, potential climate change adaptation measures to inform risk management related to climate and weather events.

5.3.4 Creation of Economic Diversification and Sustainability of Water Supply

Projects

Creation of employment has led to economic diversification through water supply sustainability as indicated by a mean of 4.19 and standard deviation of 0.16. Availability of water has led to increased farming activities and improved livelihood among the water users as indicated by a mean of 4.04 and standard deviation of 0.18. Agriculture accounts for roughly 70% of total freshwater withdrawals globally and for over 90% in the majority of Least Developed Countries (LDCs) (FAO, 2011).

5.4 Conclusions

Objective one of the study sought to find out the influence of funding on sustainability of water supply projects. The study concluded that project financial auditing, financial utilization and budget reliability affected sustainability of water supply to a great extent. Budget reliability schedules improve sustainability of water supply projects. Transparency among finance planning committees improve sustainability of water projects. Overall, project financial auditing had the least effect on sustainability of water supply and project financial utilization had the highest effect.

Objective two of the study sought to find out the influence of technological innovation on sustainability of water supply projects. The study revealed that adequate equipment, reliable water connectivity and quality of water affected sustainability of water supply to a great extent. KIWASCO water connectivity is advanced and in compliance with the current technological era. Water treatment plants are being implemented to improve sustainability of water supply. Technologically advanced tools and equipment are provided to cater for the sustainability of water supply. Overall, adequacy of project equipment had the least effect on sustainability of water supply and reliable water connectivity had the highest effect. Overall, adequacy of project equipment had the least effect on sustainability of water supply and reliable water connectivity had the highest effect.

Objective three of the study sought to find out the influence of environmental risk on sustainability of water supply projects. The study concluded that elaborate risk

management plan, risk preparedness and clear risk communication affected sustainability of water supply to a great extent. Elaborate risk management plan prevents hazards from happening in advance. Risk preparedness helps KIWASCO in getting ready for inevitable hazards for instance natural drought and famine. Risk communication and sharing helps KIWASCO in dividing its risks and losses with both private and public partners. Overall, clear risk communication strategy had the least effect on sustainability of water supply and risk preparedness had the highest effect.

Objective four of the study sought to find out the influence of economic diversification on sustainability of water supply projects. The study revealed that increased farming activities and self-sustenance, creation of employment and reduced water prices affected sustainability of water supply to a great extent. Creation of employment has led to economic diversification through water supply sustainability. Availability of water has led to increased farming activities and improved livelihood among the water users. Reduced water prices has led to increased savings and investments. Overall, creation of employment had the least effect on sustainability of water supply and reduced water prices had the highest effect.

5.5 Recommendations

Based on the study literature review and findings after the data analysis, the following recommendations were made:

KIWASCO should be scrutinized and audited by external auditors annually. This will help to ensure that funds are well utilized thus increasing sustainability of water supply. The management should ensure transparency by publishing their accounts. The management should come up with a reliable budget and involve both partners on this.

KIWASCO need to heavily invest in tools and equipment to ensure enough water supply. The pumps should be durable to avoid breakage. Water treatment plants need to be implemented and be well maintained to avoid hazardous water supply. This will in turn increase the sustainability of water supply. Water connectivity should be advanced in compliance with the current technology.

There is need to adopt risk mitigation and assessment to prevent hazards from happening in advance. KIWASCO should put in place a risk department so that they are able to deal with all the risks and if possible prevent them.

5.5.1 Suggestions for further studies

The researcher suggested further studies on the influence of public private partnership on sustainability of water supply projects in the neighboring counties for example Homabay and Kakamega.

To enhance sustainability of water supply, further research should be done on the other organizations which offer water services in the county and the challenges they face.

Further study on the challenges facing KIWASCO in its work and how they can be resolved. Another study on influence of sustainability of water supply on economic divergence in Kisumu county should also be carried out

5.6 Contribution to the body of Knowledge

Information yielded from the results of the study on how sustainability of water supply projects can be improved will be of great help to existing and newly initiated water projects.

Information generated from the result of the study will contribute towards achieving some of the key pillars in the Vision 2030 and MDGs of eradication of extreme poverty and issues to do with health.

Other development practitioners may use the recommendations there to either initiate or improve on similar programs in other counties like KIWASCO. The general public will benefit from the findings of the study for their general awareness and understanding on the operations of the public private partnership.

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APPENDICES

Appendix I: Letter of Transmittal

FREDRICK MARIWA,

P.O BOX 2274

KISUMU

CELL PHONE: 0721295403

Dear Sir/Madam,

I am a student at the University of Nairobi undertaking a Masters of Arts Degree in project planning and management. Pursuant to the pre-requisite course work, I would like to conduct a research project to assess the influence of public private partnership on sustainability of water supply projects: case of KIWASCO, Kisumu County, Kenya.

You have been selected to participate in this study and your voluntary contribution is highly valued. I kindly therefore request you to fill out these questionnaires as accurate as possible .The information you provide will be used for academic research purposes only. Your identity will be held with the greatest level of confidentiality. In case of any information or clarifications please contact me through the address above.

Thank you.

Fredrick Mariwa.

Reg. No. L50/83304/2015

SECTION B: FUNDING

5. What is the extent to which the following aspects of funding affect sustainability of water supply? **Not at all – 1, little extent – 2, Moderate extent – 3, Great extent – 4, Very great extent – 5.**

Statement	1	2	3	4	5
Project financial utilization improve sustainability of water supply projects					
Budget reliability schedules improve sustainability of water supply projects					
Project financial auditing influence sustainability of water projects positively					

6. State your level of agreement regarding whether Funding influence sustainability of water supply projects under the following aspects? **Strongly Disagree – 1, Disagree – 2, Not Sure – 3, Agree – 4, Strongly Agree – 5.**

Statement	1	2	3	4	5
Project financial utilization improve sustainability of water supply projects					
Budget reliability schedules improve sustainability of water supply projects					
Project financial auditing influence sustainability of water projects positively					

SECTION C: TECHNOLOGICAL INNOVATION

7. What is the extent to which the following aspects of technology affect sustainability of water supply? **Not at all – 1, little extent – 2, Moderate extent – 3, Great extent – 4, Very great extent – 5.**

Statement	1	2	3	4	5
Quality of water and Water treatment plants are being implemented to improve sustainability of water supply					
Technological advanced tools and equipment are provided to cater for the sustainability of water supply					
The KIWASCO water connectivity is advanced and in compliance with the current technological era.					

8. Please tick appropriately your response on the level of agreement regarding whether Technological innovation influence sustainability of water supply projects under

the following aspects? **Strongly Disagree – 1, Disagree – 2, Not Sure – 3, Agree – 4, Strongly Agree – 5.**

Statement	1	2	3	4	5
Quality of water and Water treatment plants are being implemented to improve sustainability of water supply					
Technological advanced tools and equipment are provided to cater for the sustainability of water supply					
The KIWASCO water connectivity is advanced and in compliance with the current technological era.					

SECTION D: ENVIRONMENTAL RISKS

9. What is the extent to which the following aspects of risk do affect sustainability of water supply? **Not at all – 1, little extent – 2, Moderate extent – 3, Great extent – 4, Very great extent – 5.**

Statement	1	2	3	4	5
Elaborate risk management plan prevent hazards from happening in advance					
Risk preparedness helps KIWASCO in getting ready for inevitable hazards for instance natural drought and famine.					
Clear Risk communication and sharing helps KIWASCO in dividing its risks					

10. Please tick appropriately your level of agreement regarding whether Environmental risk influence sustainability of water supply projects under the following aspects?

Strongly Disagree – 1, Disagree – 2, Not Sure – 3, Agree – 4, Strongly Agree – 5.

Statement	1	2	3	4	5
Elaborate risk management plan prevent hazards from happening in advance					
Risk preparedness helps KIWASCO in getting ready for inevitable hazards for instance natural drought and famine.					
Risk communication & sharing helps KIWASCO in dividing its risks and losses with both private and public partners.					

SECTION E: CREATION OF ECONOMIC DIVERSIFICATION

11. What is the extent to which the creation of economic diversification affect sustainability of water supply? **Not at all – 1, little extent – 2, Moderate extent – 3, Great extent – 4, Very great extent – 5.**

Statement	1	2	3	4	5
Creation of employment has led to economic diversification through water supply sustainability					
Reduced water prices has led to increased savings and investments					
Availability of water has led to increased farming activities and improved livelihood among the water users.					

12. Please tick appropriately your level of agreement regarding whether Economic diversification influence sustainability of water supply projects under the following aspects? **Strongly Disagree – 1, Disagree – 2, Not Sure – 3, Agree – 4, Strongly Agree – 5.**

Statement	1	2	3	4	5
Creation of employment has led to economic diversification through water supply sustainability					
Reduced water prices has led to increased savings and investments					
Availability of water has led to increased farming activities and improved livelihood among the water users.					

Appendix III: Interviews

Key Informants (Kiwasco Staff Member)

- i. How does funding influence sustainability of water supply projects in Kisumu County, Kenya?

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- ii. How does technological innovation influence sustainability of water supply projects in Kisumu County, Kenya?

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- iii. How does environmental risks influence sustainability of water supply projects in Kisumu County, Kenya?

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- iv. How does economic diversification influence sustainability of water supply projects in Kisumu County, Kenya?

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Appendix IV: Determining Sample Size from a Given Population

Table 1: Krejcie and Morgan Table for Determining Sample Size from a Given Population

<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note: *N* is Population Size *S* is sample Size