

**FACTORS INFLUENCING RESTORATION AND  
SUSTAINABILITY OF THE NAIROBI DAM IN NAIROBI  
COUNTY, KENYA**

By  
Julia Wangui Rugo

**A Research Project Report submitted in Partial Fulfillment of the requirement for the  
Award of the Degree of Master of Arts in Project Planning and Management, University of  
Nairobi**

**2015**

## DECLARATION

I declare that this research project is my original work and has not been presented for any award in any University.

Signature..... Date.....

Julia WanguiRugo

Registration Number: L50/61612/2013

This research project has been presented for examination with my approval as the University Supervisor

Signature..... Date.....

Prof. Charles Rambo  
Department of Extra Mural Studies  
School of Continuing and Distance Education  
University of Nairobi

## **DEDICATION**

I dedicate this study to my son Louisz Wambulwa Maina and to my mother, Mrs. Teresia Wanjiku Gachie for their support and encouragement during the preparation of this research report.

## **ACKNOWLEDGEMENT**

I am very grateful to my project supervisor Prof. Charles Rambo for his guidance and mentorship throughout the project development process up to completion. I further extend my gratitude to my office Supervisor, Mr. Ibrahim Thiaw, the Deputy Executive Director of the United Nations Environment Programme for offering me the flexibility to attend classes when I was still managing my office tasks. I would also like to express my sincere gratitude to Mr. Henry Ndede, Coordinator, UNEP-Kenya Country Programme and Mr. Richard Munang, Africa Regional Climate Change Programme Coordinator, for their coaching and guidance throughout my research study.

I would also like to take this opportunity to thank my lecturers who committed their time and effort even during weekends. Grateful to my student colleagues, who displayed team spirit, support and dedication during our course work assignments to which alone, it would have been impossible. This did not only make us complete our coursework but we have established good relationship and we continue to support and encourage one another in other informal engagements.

A vote of thanks to my entire family members for their love, prayers and moral support which gave me the courage to carry out this research work regardless of the difficulties I encountered at times. I feel indebted to them and will always cherish for the unconditional love. Above all, I would like to thank the Almighty God for giving me this great opportunity that has seen me advance my career to another level.

# TABLE OF CONTENT

	Page
<b>DECLARATION.....</b>	<b>ii</b>
<b>DEDICATION .....</b>	<b>iii</b>
<b>ACKNOWLEDGEMENT .....</b>	<b>iv</b>
<b>LIST OF TABLES .....</b>	<b>viii</b>
<b>LIST OF FIGURES .....</b>	<b>ix</b>
<b>ABBREVIATIONS AND ACRONYMS .....</b>	<b>x</b>
<b>ABSTRACT.....</b>	<b>xi</b>
<b>CHAPTER ONE: INTRODUCTION .....</b>	<b>1</b>
1.1 Background of the Study .....	1
1.2 Statement of the Problem.....	5
1.3 Purpose of the Study.....	6
1.4 Objectives of the Study.....	6
1.5 Research Questions .....	6
1.6 Assumptions of the Study .....	7
1.7 Limitations of the Study .....	7
1.8 Significance of the Study.....	7
1.9 Delimitations of the Study .....	8
1.10 Significant terms used in the Study.....	8
1.11 Organization of the Study .....	9
<b>CHAPTER TWO: LITERATURE REVIEW.....</b>	<b>10</b>
2.1 Introduction.....	10
2.2 Concept of Dam Restoration and Sustainability .....	10
2.3 Stakeholder Engagement and Dam Restoration and Sustainability .....	12
2.4 Infrastructure Development and Dam Restoration and Sustainability .....	14
2.5 Environmental Education and Dam Restoration and Sustainability .....	15
2.6 Organizational Management and Dam Restoration and sustainability .....	17
2.7 Theoretical Framework .....	18

2.7.1 Integrated Water Resources Management Theory of Sustainability.....	18
2.8 Conceptual Framework .....	22
2.9 Knowledge Gap.....	24
2.10 Summary of Literature Review .....	29
<b>CHAPTER THREE: RESEARCH METHODOLOGY.....</b>	<b>30</b>
3.1 Introduction.....	30
3.2 Research Design.....	30
3.3 Target Population .....	30
3.4 Sampling Procedure and Sample Size.....	31
3.5 Data Collection Instruments .....	31
3.5.1 Pilot Testing .....	32
3.5.2 Validity of Instruments.....	32
3.5.3 Reliability of Instruments .....	33
3.6 Data Collection Procedure.....	33
3.7 Data Analysis Techniques .....	34
3.8 Ethical Issues in Research .....	34
3.9 Operationalization of Variables .....	35
<b>CHAPTER FOUR: DATA ANALYSIS, PRESENTATIONS, INTERPRETATIONS AND DISCUSSIONS.....</b>	<b>37</b>
4.1 Introduction.....	37
4.2 Questionnaire Response Rate .....	37
4.3 Demographic Characteristics of the Respondents.....	37
4.4 Stakeholder Engagement on the Restoration and Sustainability of the Nairobi Dam .....	39
4.4.1 Target Stakeholders.....	39
4.4.2 Project Planning Meetings.....	41
4.4.3 Level of Integration amongst the Stakeholders.....	42
4.5 Infrastructure Development on the Restoration and Sustainability of the Nairobi Dam .....	42
4.5.1 Legislations and Legal Frameworks for Water Resources Governance .....	42
4.5.2 Installation of Sewerage System in Kibra Slums.....	44
4.5.3 Declaration of Dam Ownership .....	45

4.6 Environmental Education on the Restoration and Sustainability of the Nairobi Dam.....	46
4.6.1 Training Workshops to raise Environmental Awareness .....	47
4.6.2 Mainstreaming Environmental Education into School Curriculum .....	48
4.6.3 Accessibility of Environmental Management Information .....	49
4.7 Organizational management on the Restoration and Sustainability of the Nairobi Dam .....	50
4.7.1 Engaging in Public Private Partnerships (PPPs) for project implementation.....	50
4.7.2 Water Resources Management.....	51
4.7.3 Alternative Livelihoods and Settlement Plan for Informal Settlers .....	52
4.8 Discussions .....	53
<b>CHAPTER FIVE: SUMMARY OF THE FINDINGS, CONCLUSIONS AND</b>	
<b>RECOMMENDATIONS .....</b>	<b>55</b>
5.1 Introduction.....	55
5.2 Summary of Findings .....	55
5.2.1 Influence of Stakeholder Engagement on Restoration and Sustainability .....	55
5.2.2 Influence of Infrastructure Development on Restoration and Sustainability .....	56
5.2.3 Influence of Environmental Education on Restoration and Sustainability.....	57
5.2.4 Influence of Organizational Management on Restoration and Sustainability .....	59
5.3 Conclusions.....	60
5.4 Recommendations .....	60
5.5 Suggestion for Further Research.....	62
<b>REFERENCES.....</b>	<b>63</b>
<b>APPENDICES .....</b>	<b>i</b>
Letter of Transmittal for Data Collection Instruments.....	i
Introduction Letter from the University of Nairobi .....	ii
Letter of Permit .....	iii
Questionnaire .....	iv
Interview Questions .....	viii
State of the Nairobi Dam.....	ix

## LIST OF TABLES

	<b>Page</b>
Table 1	Knowledge Gap.....25
Table 2	Sampling Procedure and Sample Size.....31
Table 3	Operationalization of Variables.....35
Table 4	Demographic characteristics of the study population.....38
Table 5	Target stakeholders for dam restoration.....40
Table 6	Frequency of planning meetings.....41
Table 7	Integration of stakeholders in promoting coordination.....42
Table 8	Institutional governance in water management resources.....43
Table 9	Installation of sewerage and waste management systems.....44
Table 10	Authority for dam management control .....45
Table 11	Provision of training workshops for environmental awareness.....47
Table 12	Mainstreaming environmental education into school curriculum.....48
Table 13	Accessibility of environmental management information.....50
Table 14	Impact of PPPs engagement in project management.....51
Table 15	Appropriation of project resources for dam restoration.....52
Table 16	Alternative livelihoods and settlement plan for Kibra residents.....53



## LIST OF FIGURES

	<b>Page</b>
Figure 1	Integrated Water Resources Management Principles and their interaction.....19
Figure 2	Integrated Water Resources Management Principles at Local Level.....21
Figure 3	Conceptual Framework.....23

## **ABBREVIATIONS AND ACRONYMS**

FAO:	Food and Agriculture Organization
GoK:	Government of Kenya
IFAD:	International Fund for Agricultural Development
IFC:	International Finance Corporation
IWRM:	Integrated Water Resources Management
KICD:	Kenya Institute of Curriculum Development
KNL:	Kenya National Libraries
MaMaSe:	Mau Mau Serengeti
MP:	Member of Parliament
NACOSTI:	National Commission for Science, Technology and Innovation
NEMA:	The National Environment Management Agency
NGOs:	Non-Governmental Organizations
OKACOM:	Okavango River Basin Water Commission
PPPs:	Public Private Partnerships
QWI:	Queensland Water Infrastructure
UN:	The United Nations
UNECE:	The United Nations Economic Commission for Europe
UNEP:	The United Nations Environment Programme
UN-HABITAT:	United Nations Programme for Human Settlement
UoN:	University of Nairobi
US:	United States
USA:	The United States of America
WCD:	The World Commission on Dams
WRC:	Water Resources Commission

## ABSTRACT

The Nairobi Dam was commissioned in 1953 as reservoir for potable and emergency water supply. The dam gradually became a major attraction for recreational activities such as sport fishing, sailing, diving, picnics and other water sports. Unfortunately, heavy pollution emanating from the high-density population of the Kibra informal settlement stimulated growth of invasive plant species and curtailed recreational activities (Namale, 2013). Other problems include the lack of proper waste management and dam safety. This and other pollutants have rendered the water in the river system and the dam totally unusable and hazardous to human health. The study assessed the factors influencing the restoration and sustainability of the Nairobi Dam. The objectives of the study were to examine how stakeholder engagement, infrastructure development, environmental education, and, organizational management; could influence the restoration and sustainability of the dam. The study used quantitative and qualitative research designs to investigate and analyze the problem at hand. The data collection instruments included questionnaires, interview, observation methods, and secondary data sources. The findings were presented using tables, frequencies and percentages. The target population for the study constituted the Kibra residents, The Nairobi County Government, NEMA, UNEP and UN-HABITAT. The findings on stakeholder engagement revealed that 84.8% felt not all major stakeholders been targeted, 82.6% indicated that the project planning meetings were rare and irregular, 83.6% felt that the project stakeholders were disintegrated; On infrastructure development, 74.4% felt that the existing laws and legislations on water resources management were not enforceable, 68.6% highlighted the importance of installing sewerage and waste management system in Kibra slums, and 81.4% felt that the County Government had no control on the dam management. On the issue of environmental education, 82.5% felt that the government had not engaged the public in training to increase environmental awareness, 52.3% were of the opinion that environmental education had not been mainstreamed into national school curriculum, and 70.9% felt that the public had no access to environmental management information. On organizational management, 72.1% indicated the importance of engaging PPPs in the dam project implementation, 76.7% were of the opinion that project resources had not been properly utilized, and 81.4% did not think the government had plans to resettle and provide alternative livelihoods to the Kibra slum residents. The study recommends the engagement of all stakeholders, strengthening the governance structure and legal framework on water resources management integration of environmental education into school curriculum and government to consider defining the mandate for the Nairobi County Government to gain autonomous control of the dam and prevent political interference. Once restored, the dam could offer a source of emergency water in case of fires, a recreational resort that could create employment, a source of clean water, curb insecurity, promote environmental conservation through waste management and pollution reduction, become an invaluable asset to food security, save residents from communicable and water-borne diseases, help landlords to regain value of their property, and serve as a national treasure and tourist attraction.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

Nairobi city is the largest city in East Africa in terms of population, built up area and infrastructural development. It is a rather young city; it began in 1899 as a supply depot of the Uganda railway. Initially, it was a swamp and a watering point for the Maasai pastoralists who called it Enkare Nairobi, meaning: 'the place of cool waters'. The railway builders chose it as their supply depot due to the availability of the cool waters for them. As the city grew bigger, there was need for alternative sources of water. The first piped water was from Kikuyu springs and Kabete treatment plant developed in 1906. In 1936 the Ruiru Dam was built then the Sasumua Dam followed in 1945, both located in the Aberdare Range north of Nairobi. Deep wells were also dug to supplement the water sources of the constantly growing city that was now the capital of the British East Africa Protectorate. Amidst fears of acute water shortages in the mid-20<sup>th</sup> Century, the British Colonial Government was under pressure to provide emergency water for the city and thus the Nairobi Dam project was born. The main source of water inflow into Nairobi Dam consists of surface run off from Ngong-Mutoine River system and other rivulets thereto, from storm water, wastewater streams and discharges from the surrounding land areas of informal settlements of Kibra and low medium residential areas of Lang'ata Karen on south of reservoir/river (UNEP Report, 2004).

The Nairobi Dam which occupies 87 acres of land was designed in 1946 by the Public Works Department of the British colonial government in Kenya in conjunction with the Uganda Railways and Harbours Service. It was commissioned by the Government of Kenya in 1953 to provide emergency water supply to some parts of Nairobi and recreational, sporting, a source of fish., e.g., mudfish, catfish, etc., and bird watching activities in turn being a destination for both foreign and domestic tourists. The water demand for Nairobi is 650 000 m<sup>3</sup>/day compared to the production of 482 940 m<sup>3</sup>/day while the dam has a reservoir of 98,422m<sup>3</sup> which can help solve the problem of water scarcity. Nairobi Dam forms part of the larger Athi river basin which has an area of 132,000km<sup>2</sup> representing about 23.7% of the total land area in Kenya. It served a population of approximately 15 million approximately a third of Kenya population. Therefore,

efforts to ensure clean water in Nairobi Dam will replicate a good health and access to clean water for over 15 million Kenyans hence reducing health expenditures and improving the standard of living of Kenyans (UNEP Report, 2004).

The dam suffered severe pollution attack to the extent that by 1998, its use for sport and recreation was abandoned. The destruction of the dam has brought both social-economic effects not only to the people living around the dam but also to over a third of Kenyan population. Over the years intensive encroachment of human settlements, agricultural activities, draining of raw sewer and dumping of garbage led to eutrophication and infestation of hyacinth have rendered the dam unusable. Solid waste deposits to the dam have transformed the water reservoir into a fertile farm, feeding 62 per cent of the Nairobi's population who reside in slums and surrounding areas. There are farmers who own several plantains in the dam and their produce feeds thousands of people in Kibra, Kawangware, Kangemi and even some suburbs in Nairobi. Green sukuma wiki, arrowroots, tomatoes and sugarcane, are all growing healthy in the once acclaimed fishing park. Marijuana farming has also taken root at the dam. The dam has become virtually open clogged sewer; a source of diseases; a plight on the landscape and an impediment to urban renewal and economic development (Namale, 2013).

Restoration and sustainability of the dam will not only offer a clean water source to area residents and recreational facilities, but also assist to curb increased insecurity by smoking out gangs who have turned the dam into a hideout. It is expected that the dam would serve as a national treasure and an invaluable asset to food security, and a source of emergency water supply in case of fires. The sustainability of the dam would help landlords to regain value from their houses in Kibra as currently, the foul smell exhumed by the dam drives away potential buyers or tenants (Odongo *et al*, 2013).

There have been three attempts in the past to rehabilitate the Nairobi dam and its river basin system. The initial effort was in 2004 by the then Vice-President Moody Awori which we believe was marred by underlying issues that were more political than social and it failed; the second effort was by former Prime Minister Raila Odinga and even with all the power that came with that office he was not able to restore the dam. The late Mutula Kilonzo whilst the Nairobi Metropolitan Minister made a third attempt saying that he even wanted to one day swim in the

dam but those plans did not materialize. In the current year, 2014, a member of 11-man taskforce has been constituted and commissioned to start restoration planning and implementation strategy. In the year 2014, an 11-man taskforce was commissioned by Governor Evans Kidero to restore and sustain the dam but not much has been realized to date (Wangui, 2014).

The management of natural resources and particularly freshwater is a key human endeavour in the 21<sup>st</sup> century. Given the large number of existing dams and those that may be built in the future, it is clear that humankind must live with the environmental and social consequences for many decades to come. Most dams are built with the best of intentions: to provide water supplies and power at times when water is naturally scarce and to reduce the devastating effects of floods. These are all worthy reasons for river regulation. However, it is now recognized that if development is to be sustainable, the effects of impoundment on ecosystems and other species cannot be neglected. A pre-requisite for sustainable development is that future dam planning, construction and operation must become part of an integrated management effort that gives prominence to environmental protection (WCD Report, 2000).

Dam restoration and sustainability has been successful in many parts of the world. For instance, from a global perspective in Indonesia, a program for infrastructural development of urban and industrial wastewater treatment within the upstream catchment to reduce eutrophication in the Cirata and Saguling reservoirs was implemented and involved collaborative efforts of all partners and stakeholders with environmental management structures in place (Simeoni et al. 2000). An integrated water management strategy was developed to control water hyacinth in the Yacyreta reservoir on the Parana River in Argentina and this included biomass clearing, development of effective sewage treatment plants to reduce nutrient input to the reservoir and a program of water releases and environmental awareness (Joffe and Cooke, 1997). Mekong River Commission implemented an Integrated Water Resources Management (IWRM) approach in large and complex river basins that has helped to ensure effective management and equitable use of water and related resources. IWRM has promoted the coordinated development and management of water, land, and related resources in a way that maximizes economic and social welfare without compromising the sustainability of vital ecosystems (Gerlak and Schmeier, 2014).

From a regional perspective, the Berg River Dam in South Africa has been effectively managed because it was designed, constructed and operated in accordance with the guidelines of the World Commission on Dams. Indigenous plants have been planted on the downstream face of the dam wall, ensuring that the dam blends with the surrounding landscape. Parallel to the dam's construction alien vegetation was removed from the upper river catchment, significantly increasing the amount of water available for storage and for indigenous plant species and an Environmental Management Plan was drawn up to ensure effective environmental management of the project. (Callaway *et al*, 2009).

From a national perspective, Mt. Kenya is one of the five water towers in Kenya whose water yield contributes almost half of the flow of the Tana River basin, divided into two distinct ecosystems: the Upper Tana basin, which receives most rainfall, and the Lower Tana, which is drier and flatter. The Tana River begins in the central Kenya highlands, flowing 800 kilometres to the Indian Ocean and supports around half of the hydropower generated in Kenya; irrigated agriculture; fisheries; livestock production and biodiversity conservation, supplying water to 17 million people. To ensure sustainability, the River Basin Management and the Community Water Development sub-components invested in: establishing operational climatic and water flow data collection systems; capacity building at community and district level; and more efficient infrastructure in irrigation and domestic water use systems. The ability of the community to carry out roles in water abstraction, permitting, conflict resolution, water catchment management and conservation through the definition and implementation of Sub-catchment Management Plans is well demonstrated. There is good linkage between communities, Water Users Associations and other stakeholders. This has resulted in the reduction in water pollution and increased base flows in the five river basins (IFAD Report, 2006).

Ndaka-ini Dam, also referred to as Thika Dam was set up in 1988 to supply water to the Nairobi City residents. Constructed on piece of land, approximately 1200 acres, the dam occupies 600 acres of land, when full. The rest of the land was used as a construction site and a quarry for extraction of stones to build Ndaka-ini Dam. The dam has a capacity of close to 70 million cubic meters of water. It is located 80 kilometers north of Nairobi and 40 kilometers west of Thika town in Kenya. It is the main source of water supply for the Nairobi Water Company in Nairobi serving most of the Nairobi residents and is approximately 60 meters deep. With the ever

increasing population, the city of Nairobi has been faced with water challenges for a long time. The water shortage crisis was worst before the construction of the dam in 1984. The Ndaka-ini Dam construction was financed by the World Bank, The European Bank, The African Development Bank and the Kenyan government. The dam has helped to increase the reliability of water provision in Nairobi city and serves over 3 million Nairobi residents with clean drinking water (UNEP Report, 2007).

One of the efforts to ensure sustainability of the dam is the Ndaka-ini Marathon, an event organized every year, to create awareness on protection of the dam's catchment areas so as to ensure the dams longevity. The marathon also helps the local community living around the area to develop viable socio-economic activities related to the dam. In as much as there were a few hitches and pros to the development of the dam such as displacement of people and alteration of road networks, the dam has greatly ameliorated the livelihood of Nairobi city residents by providing clean and safe drinking water (Yatichet *al*, 2009).

In summary, it is evident that a broad body of regulation and guidelines applicable to the environmental impacts of large dams should exist at international, regional and national levels. However, incorporating environmental protection measures into large dam projects is made difficult by the failure of many developers and operators to fulfill voluntary and mandatory obligations. Principal causes for this have been identified as: failure to incorporate the primary beneficiaries, lack of and incompleteness in, policy, legal and regulatory frameworks; difficulties in accurately defining environmental requirements and specifying these in the implementation agreements of projects; lack of human, financial and organizational capacity for project appraisal and to act on infringements of agreements; lack of transparency and accountability; and weak or non-existent recourse and appeals mechanisms (WCD Report, 2000).

## **1.2 Statement of the Problem**

Human welfare and economic development generally depend on the use of water. In Kenya for instance, water resources management and utilization is crucial to the country's effort to reduce poverty, grow economy, ensure food security and maintain ecological systems. The Nairobi Dam, one of the City's major sources of emergency water in case of fires has become heavy polluted with heaps of uncollected garbage and human wastes from informal settlements and



other pollutants that have rendered the water in the feeding rivers and the dam totally unusable and hazardous to human health. The growth of invasive plant species has also completely curtailed recreational activities at the dam. Acute water shortage in the city has become the order of the day for the Nairobi residents. The Nairobi Water Company, in charge of water management in Nairobi continues to ration water distribution, resulting to residents buying water from vendors, posing a health risk as source of the water is unknown. The water vendors also sell the water exorbitantly to residents and affordability is also becoming a major concern. This situation is what prompted the need to find out factors that could influence of the restoration and sustainability of the Nairobi Dam.

### **1.3 Purpose of the Study**

The study sought to assess the factors influencing the restoration and the sustainability of the Nairobi Dam.

### **1.4 Objectives of the Study**

The study was guided by the following objectives:

1. To examine how stakeholder engagement influences the restoration and sustainability of the Nairobi Dam.
2. To determine how infrastructure development influences the restoration and sustainability of the Nairobi Dam.
3. To establish the extent to which environmental education influences the restoration and sustainability of the Nairobi Dam.
4. To assess how organizational management influences the restoration and sustainability of the Nairobi Dam.

### **1.5 Research Questions**

The study sought to answer the following research questions:

1. How does stakeholder engagement influence the restoration and sustainability of the Nairobi Dam?
2. How does infrastructure development affect the restoration and sustainability of the Nairobi Dam?

3. To what extent does environmental education influence the restoration and sustainability of the Nairobi Dam?
4. How does organizational management influence the restoration and sustainability of the Nairobi Dam?

### **1.6 Assumptions of the Study**

There was an assumption that respondents especially from the County Government would give reliable information to increase the validity and reliability of the findings. The study also assumed that anonymity and confidentiality of the respondents would be preserved and that respondents were volunteers who were at will to withdraw from the study at any time and with no ramifications.

### **1.7 Limitations of the Study**

The study faced the following challenges to its successful completion. Firstly, the time for data collection was very limited because of a busy work schedule. In order to manage this limitation the researcher sought permission from work to collect data. There was also some difficulty in obtaining reliable information from the County Government due to fear that the respondents might be victimized. The researcher assured the respondents that the data collected was purely for academic purposes and the collected information would remain confidential.

### **1.8 Significance of the Study**

It is expected that the study would show added value that the restoration and sustainability of the Nairobi Dam would bring. This would include saving the City from the frequent acute water shortage through provision of clean drinking and emergency water in case of fires, economic gain from recreational facilities through creation of employment, curb insecurity since in the current state the area is a hide-out for gangs, help to promote environmental conservation through solid waste disposal management and pollution reduction, become an invaluable asset to food security, help to save residents from communicable and water-borne diseases, for example, cholera, diarrhea, etc., assist landlords in regaining the value of their property as the foul smell emanating from the dam drives away potential tenants and investors. It is expected that the rehabilitated dam would serve as a national treasure and a tourist attraction.

## **1.9 Delimitations of the Study**

The focus of the study is on the Nairobi Dam. The geographical region covered by the study is the dam area and the riparian zones occupied by informal settlers. The study would have also wanted to check on the contribution of the Nairobi River to the state of the Dam but the scope is limited to the dam because the objectives are also specific on the factors affecting its sustainability within the geographical zone. The study was limited to the residents of Kibra and not residents of Lang'ata in order to maintain the scope of the study.

## **1.10 Significant terms used in the Study**

**Stakeholder Engagement** involves sharing information, consulting and collaborating with the key stakeholders. This eventually increases accountability, transparency, building trust, partnerships and empowerment. It also creates a sense of ownership when people are made responsible and accountable for their actions, thus, promoting social, economic and environmental sustainability.

**Environmental Education** involves sensitizing public and other stakeholders on ecological, economic, social and cultural interdependence; promoting effective public participation in decision-making; creating new environmental-friendly behaviour; and, encouraging sustainable lifestyles and fostering ethical responsibility.

**Infrastructure Development** involves setting up sound legislation and legal frameworks, enforcement and compliance mechanisms, development of transport and communication networks, including purification and waste management systems for water resources management.

**Organizational Management** involves putting in place governance structures for implementation; planning for human and material resources; monitoring and evaluation to ensure effective project management and service delivery.

**Restoration and Sustainability** involves the recovery of an ecosystem that has been degraded, damaged or destroyed, and being able to maintain the same restored state without deterioration

after restoration, eventually leading to improvement of people's standards of living and promoting environmental conservation.

### **1.11 Organization of the Study**

This study is organized as follows: Chapter Two provides the review literature from empirical review, theoretical framework, conceptual framework, knowledge gap and summary of literature. Chapter Three details the research methodology to be applied to carry out the research and will compose of the research design, target population, sampling procedure and sample size, research instruments, validity of instruments, reliability of instruments, data collection procedure, data analysis techniques, operational definition of variables and ethical issues in research. Chapter Four give the analysis of data, presentation and interpretation of results and discussions; and Chapter Five provides a summary of the findings, conclusions and recommendations.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

The chapter presents the relevant literature on the topic of study and captures two themes, namely: the theoretical and conceptual frameworks, to help increase the understanding the variables related to the study and to present a preferred approach as per the study perspective. The Chapter also presents the relevant literature on dam projects from national, regional and international perspective, outlining factors that have contributed to success or failure of dam projects.

#### **2.2 Concept of Dam Restoration and Sustainability**

Water management projects affect a large portion of rivers throughout the world. Dams are an important international issue because nearly half of the world's rivers have at least one dam; large dams generate 20% of the world's electricity; 30-40% of the world's irrigated land relies on dams; and 40 to 80 million people have been displaced by dam reservoirs. Their restoration and sustainability is therefore essential to ensure sustainable use and management of natural resource (WCD Report, 2000).

According to Nellemann (2010), without innovative financial arrangement involving Public Private Partnership, it would not be possible to undertake a carefully planned and phased wetland restoration. A good example is The Little Pine Island in the USA. Recognizing the ecological significance of the Island now which is strategically located within the 40,000 acre Charlotte Harbor State Park in the State of Florida, acquiring funds to cover the anticipated cost was a daunting task. In the early 1990's, a concept of mitigation banking appealed to both the State of Florida and a private developer. In 1997, restoration activities began, undertaken as a Public Private Partnership that was formed between Marina Properties Development Inc., and the State at the Little Pine Island Wetland Mitigation Bank. One of its kind in the US, the bank privately financed over 12 million US Dollars in habitat restoration and its perpetual sustainability, ultimately from the sale of bank credits. This led to recovery of the fresh and saltwater marshes, mangroves and slash pine wetland vegetation that for decades had been dormant in the soil sprouted to produce well-balanced native ecosystems replete with wildlife.

Study undertaken by Mensah (1996) on the Water Laws, Water Rights and Sustained Water Supply in Ghana revealed prior to the enactment of the 1992 Constitution that no single institution in Ghana had authority over the water sector. Following the intent of Articles 269 of the new Constitution of 1996, the Ghana Parliament passed the Water Resources Commission Act (WRC Act 522, 1996). The primary responsibilities of the new WRC included: proposal, coordination, and monitoring of plans and activities related to the development, improvement, utilization and conservation of water resources; granting of water rights, collection, collation, storage and dissemination of data and information on water resources; acquisition of water user agencies to undertake research and experiments into water resources; monitoring and evaluation of programmes for the operation and maintenance of water resources; advising the government on water resources; and advising pollution control agencies on the management and control of the pollution of water resources. The Act has empowered the WRC to manage the nation's water resources, and created in part, to remedy the problems of unclear, conflicting or redundant mandates that characterized the sectoral approach to water resources management that prevailed prior to the passage of Act 522.

Water sustainable initiative in the Mau Mau Serengeti in Kenya confirms that water influences many aspects of socio-economic development and environmental sustainability. Headwater forests in the Mara River Basin have historically recycled water, enhanced rainwater infiltration, and stabilized erodible soils. However, decades of encroachment, deforestation and poor agricultural practices have diminished recycling, promoted rapid runoff of rainwater and polluted rivers. Downstream users were also experiencing the changes as dwindling rivers in dry seasons, more extreme floods in wet seasons, death of cattle and wildlife, and sickness among people. Overgrazing and inappropriate agriculture in the rangelands also led to increased runoff of valuable rainwater and degraded water quality (McClain , 2014).

The MaMaSe initiative structural change process included the development of effective river basin management strategies through participation process in order to benefit people and the ecosystems; creating facilities and allowing residents to benefit from economic activities that are financially profitable, environmentally sustainable, and well aligned with the basic water management strategy. This was done through innovative agriculture practices and promotion of sustainable tourism facilities, and ensuring that key forest and savannah ecosystems are protected

and restored, and wildlife has access to habitats and sufficient water resources. The initiative has realized improvement in water safety and security in the Mara River Basin, through the support of structural poverty reduction, sustainable economic growth and conservation of the basin's ecosystem. The MaMaSe initiative has so far supported people and institutions of the Mara River Basin to reverse declining trends and for structural change and promoting water-wise economic development, economic growth, ecosystems conservation, and self-reliance of the people in the basin quality (McClain, 2014).

### **2.3 Stakeholder Engagement and Dam Restoration and Sustainability**

Stakeholder engagement is increasingly becoming a part of mainstream business practice and central to public policy decision-making and delivery. It entails information sharing, consultation for accountability and transparency, collaboration to build trust and empowerment to gain ownership. It helps to improve communications, attain social equity, obtain wider community support or buy-in for projects, gather useful data and ideas, enhance public sector or corporate reputation, and provide for more sustainable decision-making (IFC Report, 2007).

According to Scott (2007), factors that enhance community engagement, and build group capacity and partnerships with local government and industry are closely linked. A study on engaging urban communities in community-based sustainability in New Zealand confirmed that leadership, planning and communication strategies were critical, as was a willingness to identify and engage existing community organizations, resources, knowledge and skills. Groups recognized that residents were motivated to become involved in community-based restoration groups by a wide range of factors, and therefore flexibility and creativity was needed to enhance community engagement. Engagement approaches such as 'Adopt a site' provided regular opportunities for residents to connect with and become involved in caring for their local area. Groups had built working relationships with local government with varying degrees of participation. The availability of resources and level of community engagement were critical factors in the ability of groups to build effective partnerships with local government. Community-based groups have considerable local knowledge and experience, and, with adequate institutional support, make valuable contributions to water catchment management and sustainability.

To encourage stakeholder participation in the planning, development and use of water resource, Zimbabwe embarked on a water reform system which saw the initialization of the Water Resources Management Strategy in 1995 with the assistance of the Government of Netherlands, Norway, United Kingdom and Germany and the promulgation of two Acts of Parliament, namely the Water Act (Chapter 20:24) and The Zimbabwe National Water Authority Act (Chapter 20:25) in 1998. These two Acts established stakeholder institutions, namely the Catchment Councils and Sub-Catchment Councils. A dam, Save Catchment was constructed with full participation of all key stakeholders who included the Government through different departments, NGOs, the private sector, and Ward 6 community members. The concerted efforts by all stakeholders led to the successful development and sustainability of the Mutaza Dam water resources project. Following the water reform process, Zimbabwe has been said to be now leading the rest of Southern Africa in implementing Integrated Water Resource Management (IWRM) for the restoration and sustainability of water catchments particularly the aspect of stakeholder participation (Gozo,2011).

Borrini-Feyerband (1996) established that stakeholder engagement was important for the sustained success of the community-based wetland management to be achieved. During the implementation of the community-based wetlands conservation project in the Nyando River in Kenya, the intervention benefited greatly from collaborative partnership. The Nyando project introduced community mobilization which was anchored in five principles. These included: i) Empowerment: the actual transfer of economic and political power from the few to the impoverished many, and the operationalization of community management and control; ii) Equity: Where communities as a whole rather than a few individuals benefit; iii) sustainability: which ensures development through resource-extraction practice consider the limits of the resources-then carrying and assimilative capacity, ultra-generational equity or equity between the present and future generations; iv) systems orientation: where the community functions in the context of other communities and stakeholders, just as resources are ecologically linked to wider ecosystems; v) gender-fair: where women were involved in the control and management of community resources and their practical and strategic needs addressed. This approach further ensured that communities were backed by a legal framework on rights, benefits (direct and indirect) and economic incentives to take substantial responsibility for sustained use of resources.



## **2.4 Infrastructure Development and Dam Restoration and Sustainability**

In his study towards a system-based approach in infrastructure development in Australia, Taylor (2009) established that integrating the need for major infrastructure development with an ongoing commitment to communities and the environment was a driving force behind a new approach for sustainable development in major projects, where there was increasing pressure on water resources due to high population. In 2006, the Queensland Government established Queensland Water Infrastructure (QWI) to develop and manage major water infrastructure projects in south-east Queensland. Csiro Sustainable Ecosystems has been working with industry to develop solutions to deal with the challenge of social, economic and environmental sustainability. The principles they have developed for QWI's project focus on three areas: sustainable communities, sustainable enterprises and ecologically sustainable catchments. The type of initiatives developed by QWI under these broad themes included, developing options for relocating displaced residents within the local area, creating employment opportunities during construction, and encouraging restoration of riparian vegetation and wetlands and these have served well in infrastructure planning and development.

Improving water management is an essential component of sustainable development policies. The management of water resources still poses challenges in many African countries. Natural conditions account for a large part of this difficult situation as most of Africa's continental landmass is classified as arid or semi-arid and 60 per cent of the population lives in zones with mean annual runoff of 600 Millimeters or less. However, water stress is also the consequence of under-developed infrastructure. The lack of dams and deep wells seriously reduces the capacity of local populations to collect and store water. Also, weak water and wastewater management strategies play an important role in the degradation of water bodies. The lack of water treatment facilities in urban areas reduces the access of the local population to potable water. The use of unsustainable agricultural practices contributes to soil depletion, land degradation, and wasteful use of scarce water resources. Hence, the Lunfumbu village case in Zimbabwe, shows how a community of poor villagers can organize itself to define its priorities and manage the construction of a local water supply scheme (WCD Report, 2000).

The Tana River Basin in Central Kenya supports around half of the hydropower generated in Kenya; irrigated agriculture; fisheries; livestock production and biodiversity conservation; and

supplying water to approximately 17 million people. Over the years, there has been growing concern that these life supporting functions are systematically being lost due to degradation within the upper and middle catchment of the river. Increasing destruction of forest cover, inappropriate land use practices in the farmlands and overgrazing in the pastoral lowlands triggered increasing soil erosion and floods occurring during the rainy seasons from the bursting of river banks. As a result, river basin management and the community water development was introduced through the establishment of operational climatic water flow data collection systems, capacity building at community and county levels, and the introduction of efficient infrastructure in irrigation and domestic water use systems. Overall, the project has supported the communities in the introduction of alternative and more efficient water technologies which have reduced the pressure on surface river water use, thus leaving more to flow downstream. (IFAD & GoK, 2012).

## **2.5 Environmental Education and Dam Restoration and Sustainability**

According to a UNECE Report (2011), the shrinking of the Aral Sea is one of the greatest man-made environmental disasters of the twentieth Century and has affected the livelihoods and health of millions of people in Central Asia. The tragedy provided a shocking example of disastrous consequences of the unsustainable use of water resources. As a result of this, the Berlin Water Process was launched by the Federal Republic of Germany at the first “Water Unites” Conference in 2008 in Berlin, becoming a new start in international efforts to find effective and long-term solutions to the complex problems related to the management of water resources in Central Asia. The United Nations Economic Commission for Europe (UNECE) led the implementation of the programme – building capacity and strengthening institutions and legal frameworks in water management in Central Asia. In 2009-2011, UNECE Dialogue Project, organized at the national and regional levels, capacity-building activities on international water law and expert management on the strengthening of legal and institutional framework for regional water cooperation in Central Asia. These activities demonstrated that government authorities and other stakeholders in the countries in Central Asia were in need of strengthening their understanding and environmental awareness on water issues, water law and the awareness of best practices for the management of trans-boundary waters.

The drought of 1992 in Namibia focused the attention of the Government on the importance of educating the Namibian public about scarce water and wetland resources and the National Water Awareness Campaign was launched. Over the last 16 years, the Directorate of Resource Management in the Department of Water Affairs and Forestry together with the Wetlands Working Group of Namibia and the Desert Research Foundation of Namibia have been responsible for coordinating the efforts of government, Non-governmental Organizations (NGOs) and private sector to create an awareness and appreciation of vital water and wetland resources. The Ministry coordinates annual World Water and Wetland day event. For example, in 2008, an awareness conference on “Healthy River Basins” was held alongside the Okavango River to mark World Wetland and World Water days. This allowed those involved in the river basin management throughout Namibia to share experiences. Each year, schools are invited to participate in annual, national water and wetland competitions and Nature Conservation at the Polytechnic of Namibia, who, in future, will be the ones responsible to care for our precious water and wetland resources, are encouraged to do their practical research projects, investigating pertinent river basin and wetlands issues(Bethune, 1996).

Awareness creation is a strategy that was used to ensure sustainability of the Nyando wetland resource in Kenya. To stimulate maximum informed participation, several approaches of awareness creation were used, targeting different stakeholders. These included public barazas, exchange visits, broadcasts of well packaged information through national radio station which was popular and effective with the local community. Seminars, workshops, brochures and posters provided proved useful among community leaders and residents. Schools also spread the awareness through drama, songs, among others; through their involvement in the World Wetland Day celebration and tree planting activities. Capacity building for natural resources management goes beyond traditional, top-down approach of enhancing skills and knowledge through training and provision of technical advice. The approach to community capacity building aimed at ensuring there was empowering experience for communities engaged in development programmes, so that their capacity is sustained after the project or programme ends (Raburu *et al*, 2012).

## **2.6 Organizational Management and Dam Restoration and sustainability**

In many parts of the world, water ethnic and a focus on sustainability inform both policy and practice. For example, water allocation systems in Australia and South Africa reveal opportunities to integrate ecological considerations. Watershed-based management institutions protect ecosystems and nature is recognized as a legitimate “user” of water. In California, for example, urban water management and innovation go hand in hand. Conservation planning, increasing water efficiency and improving water reuse and recycling are fundamental aspects of water management. In Europe, new and experimentalist governance systems modify the government’s water management role. In France, for instance, instead of being the central controller, government now acts as a facilitator of local decisions in the context of river basins and watersheds. Government, through a central river basin agency acts as a clearinghouse for information and helps to develop policies and plans that address basin-wide problems. These plans and policies provide guidance to the nested management bodies of the smaller watersheds, which in turn develop detailed action plans tailored to local conditions (Desveaux, 1994).

The Cubango-Okavango river basin which is shared by Angola, Botswana and Namibia, remains one of the least human impacted river basins on the African Continent. Through the 1994 agreement that established the Permanent Okavango River Basin Water Commission (OKACOM), the three basin States expressed their bold commitment to develop a joint, cooperative management regime for the economically, socially and environmentally sustainable development and management of the Basin. Central to the Structural Adjustment Programmes was the improvement of livelihoods of the basins people through the cooperative management of the basin and its shared natural resources. Areas identified included: basin development planning and management based on shared vision; focused environmental and social economic monitoring programmes to support management decisions and tracking of long-term trends established and strengthened; integrated planning criteria and objectives for sustainable development of water resources; and technical capacity in the basin and involvement of shareholders in implementation. Through this process, OKACOM was able to create a solid opportunity to craft the science-based approached for planning and management, and decision-making (FAO Report, 2012).

The hydrographic basin of the Ewaso Ng'iro River at the foot of Mount Kenya provides water resources for intensive farming upstream, and for small farming and nomadic herdsmen downstream. Competition is very high in this semi-arid zone and the stronger competitor wins. Some large-scale farmers irrigate excessively, and the poorer populations downstream are deprived of the water they need to survive. An integrated water resources management was set up to cope with the situation consisting of different parts: drawing up data on the basins true potential through measurement of the water flow and the quantities used using computer models; meetings and discussion workshops between government representatives and the different user groups in order to pinpoint the problems and search for joint solutions; training in appropriate technologies in techniques including drip irrigation, planting of crops that combat erosion and can be used as fodder, among others; institutional support which included training and institutional consolidation; awareness raising campaigns for the local population among others. In addition, the creation on Water User Associations was also key element in integration approach, offering all players a platform for debate and action with a view to cooperative management solutions (Wenger et al, 2003).

## **2.7 Theoretical Framework**

The theoretical framework in the study guided the research and helped to determine what was to be measured and the type of statistical relationships that had to be looked for in the study.

### **2.7.1 Integrated Water Resources Management Theory of Sustainability**

The Global Water Partnership defines IWRM as: “a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems” (Dukhovny, 2000).IWRM is based on the three principles of social equity, economic efficiency and ecological sustainability.

These principles form a method of analyzing and subsequently managing water resources in a way that leads to a coordinated outcome. The interaction between the principles is shown in Figure 1.

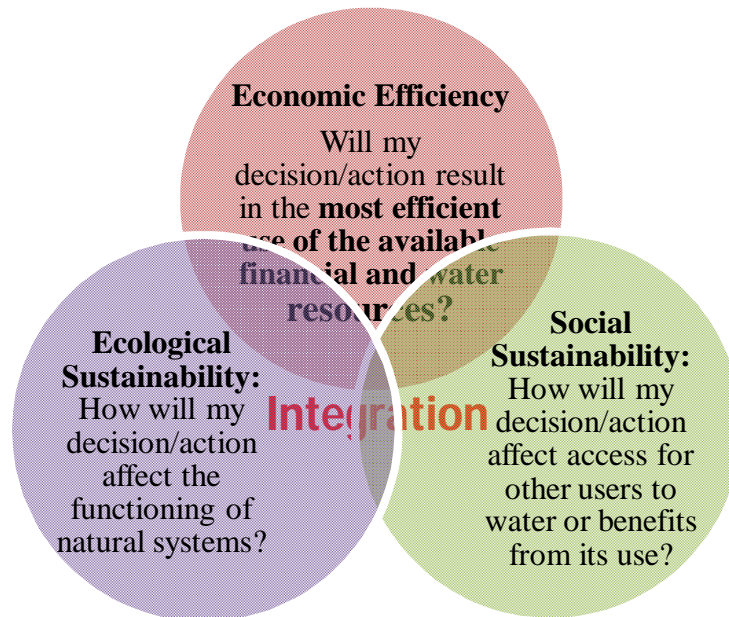


Figure 1: IWRM Principles and their interaction (Adopted from Philip *et al*, 2008)

Throughout the world, Integrated Water Resources Management (IWRM) is being promoted to help better understand, protect and develop water resources in a coordinated fashion, thus contributing to sustainable development. As pressure on water resources increases globally due to population growth, pollution and possible impacts of climate change, IWRM is seen as a framework for thinking about a more sustainable approach to the management and use of water resources.

Social equity is the principle of social equity refers to the consequences of decisions and actions faced by different water users. The focus is particularly on ensuring equity in access to, and use of, water resources and the derived benefits. This applies to all social groups regardless of economic status, spatial location and individual characteristics of its members such as their gender, age, health conditions or level of income. Social equity can, for example, be increased by: involving and consulting all water users and stakeholders in water resources decision-making to ensure more equal opportunity is given to voice needs and expectations, independent of

economic power or social status; allocating available water equitably among all users to fairly distribute economic benefits, improve livelihoods and ultimately alleviate poverty; and reducing negative impacts from local activities on water users in up or downstream areas of the catchment outside Local Government boundaries.

On the other hand, the principle of economic efficiency addresses the need to make the most economic use of water resources to attain the highest value returns, thus achieving the greatest benefit for the greatest number of people. This value is not only a price issue, but should also include current and future social and environmental costs and benefits. The principle of economic efficiency in water resources management can be taken forward by applying measures such as the following: adopting a precautionary approach to avoid shifting costs into the future; reducing or redirecting demands on water resources within the domestic, agricultural, industrial and public sectors; and recycling wastewater in order to use a unit of water with optimum efficiency.

Ecological sustainability recognizes the environment as a user in itself and calls for maintaining the services that ecosystems provide. As such, water resources should not be depleted beyond the limits of replenishment by natural processes or human intervention. This applies not only to this generation, but also to the ones that follow. Managing water resources while paying attention to ecological sustainability can be achieved through measures such as the following: raising widespread awareness of the vulnerability of ecosystems and the services they provide; promoting economic activities that have less damaging impacts on water ecosystems; and passing and enforcing regulation aimed at protecting the local ecology (Philip et al, 2008)

The consideration of different aspects of water resources management simultaneously characterizes the Integration element of IWRM. From a Local Government perspective, integration can occur in different ways, such as: the integration of social, economic and ecological considerations into the Local Government mandates that are directly or indirectly related to water resources; and the integration of activities by different Local Government departments to increase performance efficiency and effectiveness; the integration of the views of a wide range of local stakeholders to generate a broad basis of knowledge and resources,

strengthen ownership and develop more appropriate interventions; the integration of local activities with those up and downstream; and the integration of future needs into current planning processes. Such an integrated approach allows for a more informed decision-making process that considers the impacts of actions on other water users and ecosystems – and, vice versa, how other water users and ecosystem functions affect local water use (Mehtonen et al, 2008).



Figure 2: IWRM Principles at local level (Adopted from Mehtonen et al, 2008)

Local Governments are well placed to take part in IWRM due to their proximity and understanding of the living conditions, economic situation, cultural traditions, social conflicts, etc., of the local population. As clearly shown in Figure 2, an integrated approach requires a more detailed analysis of the short and long term social, environmental and financial consequences of taking alternative courses of action in many daily Local Government tasks – a pre-requisite for a better performance of regular mandates (Rahaman & Varis, 2005).



## **2.8 Conceptual Framework**

The conceptual framework in Figure 3 shows the interrelationships between the variables, independent variables being factors that influenced the dependent variables in the study. The researcher determined what dependent variable to measure through questionnaire items. The independent variables became parameters that would be measured and their effect on the dependent variable determined. From the reviewed literature, the study was categorized into four categories on the influence of restoration and sustainability of the Nairobi Dam and these included: stakeholder engagement, infrastructure development, environmental education, and organizational management. These became the independent variables for the study and were conceptualized to determine whether they influenced restoration and sustainability of the Nairobi Dam.

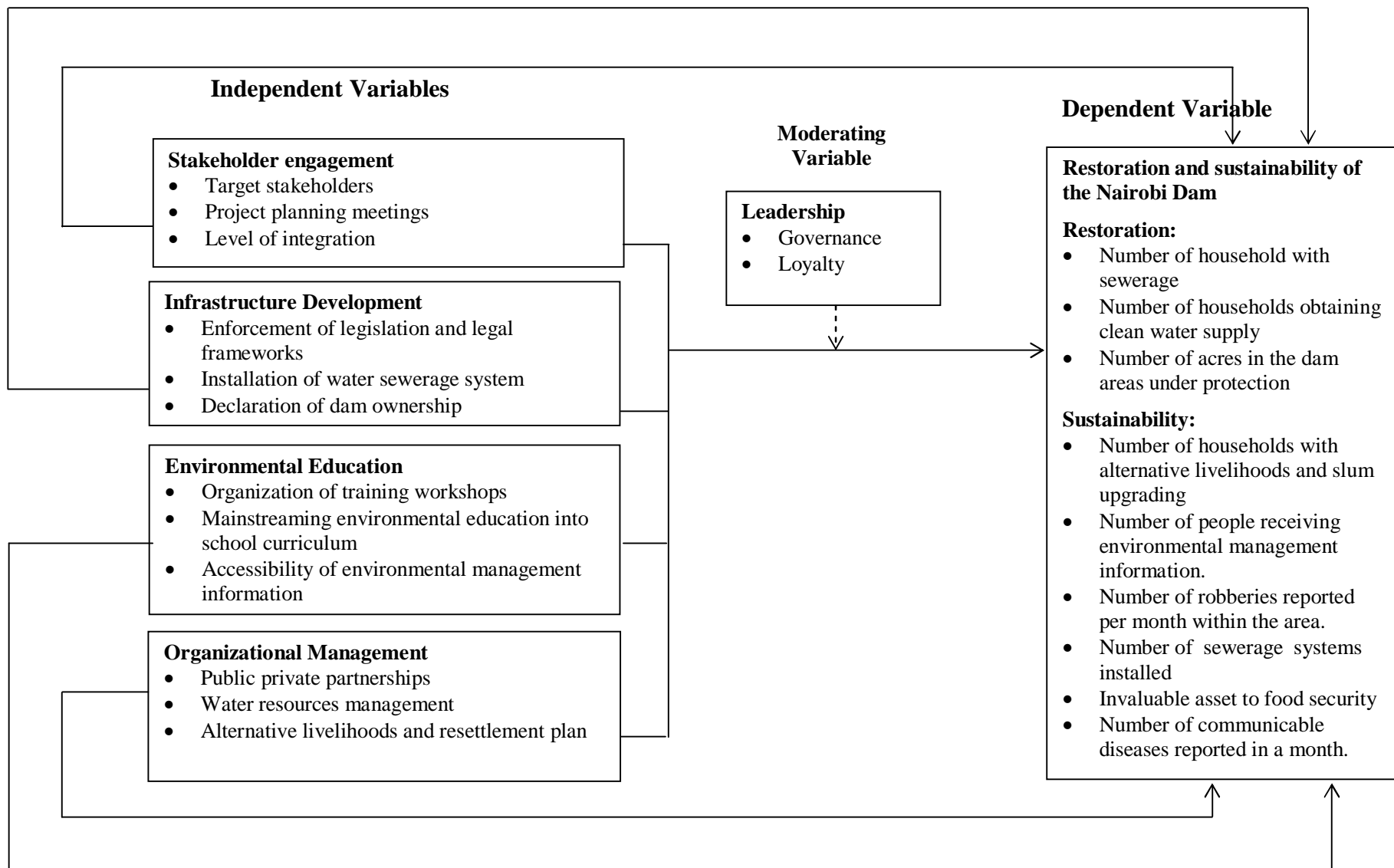


Figure 3: Conceptual Framework

## **2.9 Knowledge Gap**

The independent variables in the research expected to influence in the restoration and sustainability of the Nairobi Dam are stakeholder engagement, infrastructure development, environmental education, and organizational management. The expected outcome is successful restoration and sustainability of the Nairobi Dam when all the four independent variables have been integrated.

**Table 1: Knowledge Gap**

Variable	Author (Year)	Study	Findings	Gap in Knowledge
Stakeholder Engagement	Scott (2007)	Engaging Urban Communities: Six Case Studies of Auckland Community- Based Restoration Project.	Leadership, planning and communities strategies were found to be critical, with a willingness to engage existing community organizations, resources, knowledge and skills.	Factors like raising awareness of the importance of the project and information sharing are found to be lacking in this study.
	Gozo (2011)	Stakeholder participation in water resources planning and Development: Roadmap to the sustainability of Mutasa Dam, Ward 6m Buhare North, Zimbabwe	Stakeholder participation was found to be a lacking link in development and management of the country's resources. Following water reforms process, Zimbabwe is now leading the rest of the South Africa in IWRM.	The focus was only on stakeholder participation and infrastructure development. Environmental education and training, and organizational management were not factored.
	Borrini-Feyerband (1996)	Collaborative management of protected areas: Tailoring the approach to the context	Stakeholder engagement was important for sustained success in the management of community-based wetland through collaborative partnership. Intervention to this approach included: empowerment, sustainability, systems orientation and gender-fair. The approach ensured that communities were backed by a legal framework.	The study does not feature environmental education to sensitize the community on the important of their role in the conservation project.
Infrastructure Development	Taylor (2009)	Towards a systems-based approach to planning infrastructure, South-East	Scarce water resources due to high population growth; inexistence of a sustainability	Under-developed infrastructure; lack of environmental education and

Variable	Author (Year)	Study	Findings	Gap in Knowledge
		Queensland, Australia	framework; unsustainable communities, enterprises and ecological catchments; and unsustainable management and restoration of riparian land	training to promote environmental management; and inefficient management systems to sustain communities and ecological catchments.
	WCD Report (2000)	Kariba Dam: Zambia and Zimbabwe	Community organizations defining priorities in the management of water supply scheme leading to construction of Kafue Gorge hydro-electric dam downstream.	Lack of integration of environmental education and training to ensure sustainability and ownership of the project.
	IFAD & GoK (2012)	Impact Assessment Report: Mount Kenya East Pilot Project	River-basin management and community water development through establishment of operational climate water flow data collection systems, capacity building, use of efficient water technologies that reduce water pressure on surface river water use and lead to more flow downstream.	Lack of integrating environmental education and training to increase awareness and ensure sustainability of the project.
Environmental education	Bethune (2008)	Water resources management plan for the Kuiseb Basin:  An environmental education strategy for integrated water resources management, Windhoek, Namibia	More focus on the importance of scarce water and wetland resources; environmental education and training mainstreamed in school curriculums; and creation of awareness and appreciation of vital water and wetland resources	No focus on infrastructure development; organization

Variable	Author (Year)	Study	Findings	Gap in Knowledge
	Raburu, et al (2012)	Community Based Approach to the management of Nyando Wetlands, Lake Victoria Basin, Kenya	Target stakeholder participation and environmental awareness-raising.	The study does not focus on infrastructure development and organizational management.
	UNECE Report (2011)	Strengthening Water Management and Trans-boundary Water Cooperation in Central Asia: The Role of UNECE Environmental Conventions.	Capacity building and strengthening institutions through legal frameworks in water management; strengthened understanding and environmental awareness on water issues, water laws and awareness of best practices for the management of trans-boundary waters.	Management of water resources and collaborative partnerships not mentioned in the study.
Organizational management	Desveaux (1994)	Anticipating Uncertainty: The Strategy-Structure Problem in Public Bureaucracy Governance.	Conservation planning, increased water efficiency, improving water reuse and recycling; modification of government's water role from controlling to facilitator to allow for local decisions by community-based organizations	Study does not feature stakeholder engagement and environmental education to raise environmental awareness.
	FAO Report (2012)	Managing Africa's Water Resources: Integrating Sustainable use of Land, Forest and Fisheries.	Improving livelihoods of basins people through cooperative management and shared natural resources; basin development planning; focus on environmental, social and economic monitoring program to support decisions; involvement of stakeholders; and creation of solid opportunities to craft science-based approach to planning.	Environmental education to increase awareness and gain support in the project has not been mentioned as a factor.

Variable	Author (Year)	Study	Findings	Gap in Knowledge
Organizational Management	Wenger, et al (2003)	InfoResources Focus Journal	Integrated Water Resources Management practices; awareness raising; planting of crops to combat erosion; and offering a platform for debate and consultations.	No emphasis on stakeholder engagement; environmental education; and organizational management.

Whilst the above studies under review provide informative perspective with regards to sustainability of dam and river restoration projects, they are very limited to specific fields and do not provide cross-cutting analysis of factors affecting sustainability. On the restoration of dams, they are inclined to ecological restoration which much defines biodiversity but not the maintenance and sustainability of the dam.

Further, most of the past studies focus mainly on dams' removal due to their adverse environmental impacts on the biodiversity. Many of the dams that had been constructed had to be removed since they affected the aquatic life and the ecosystem as a whole in the river basin, including displacement of people who were initially occupying the land before the dam was constructed and were not adequately compensated.

From the past studies reviewed, it is evident stakeholder emphasis is not highlighted whenever a government wanted to construct a dam. This is the result of the adverse environmental impacts realized after the dam construction which include the problem of solid waste management, a good example being the Nairobi Dam.

## **2.10 Summary of Literature Review**

The chapter reviewed the relevant literature in relation to the research questions presented in the study. It identified the influence of stakeholder engagement, infrastructure development, environmental education and organizational management in the restoration and sustainability of wetlands from a national, regional and global perspective. It is clear that most of the projects highlighted have used one or two of the variables in the study but sustainability is not guaranteed when all the four independent variables have not been integrated. This therefore creates relevance to the study under investigation.



## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter discussed the methodology used in collecting data to support the research. The elements included research design, target population, sampling procedure and sample size, methods of data collection, validity and reliability of research instruments, data collection procedure, data analysis techniques, operationalization of variables and ethical issues to be considered when conducting the study.

#### **3.2 Research Design**

The purpose of the study was to find out the factors influencing the restoration and sustainability of the Nairobi Dam. To achieve this, a descriptive research design was chosen. This method was preferred because according to Best (1970), it is concerned with the conditions that exist, practices that prevail and the beliefs and attitudes that are held, relationships and the processes that are ongoing, effects being held and developing trends.

Pinsonneault & Kraemer (1993) defined a survey as a means for gathering information about the characteristics, actions, or opinions of a large group of people. They are also used to assess needs, evaluate demand, and examine impact. The research design assessed the relationship between the independent and the dependent variables, ensuring that the data collected was not limited to preconceived questions and categories and as a consequence, it resulted to consistency and increased the accuracy of data.

#### **3.3 Target Population**

The target population for the study was comprised of 500 from Kibra residents occupying the riparian land, 60 from the Nairobi County Government, 60 from The National Environment Management Agency (NEMA), 60 from The United Nations Environment Programme (UNEP) and 60 from The United Nations Programme for Human Settlement (UN-HABITAT).

### 3.4 Sampling Procedure and Sample Size

Sampling is a procedure where a fraction of the data is taken from a large set of data and an inference is made to represent the whole group. The population was divided into five distinctive groups. The study used simple random sampling on each of the clusters since they were homogenous and shared the same characteristics. All subjects were initially grouped into clusters and then simple random sampling was undertaken on the various clusters, listing them and a particular ( $n^{\text{th}}$ ) subject selected for the study.

Sham et al (2002) argue that 10% to 20% of the accessible population is acceptable in descriptive research and further indicates that the higher the better. The study chose 15% of the 500 Kibra residents occupying the riparian land and 15% of 240 employees and experts from the other stakeholders to make the sample size. To calculate the sample size: 15% of 500 = 75 residents and 15% of 240 = 36. Since the other stakeholders were in clusters of 4; 36 was divided by 4, obtaining 9 respondents for each group.  $75 + 36 = 111$ (total number of respondents).

**Table 2: Sampling Procedure and Sample Size**

<b>Clusters</b>	<b>Target population</b>	<b>Sample size</b>	<b>Percentage of Total Sample Size (%)</b>
Kibra Residents	500	75	68%
The Nairobi County Government	60	9	8%
National Environment Management Agency	60	9	8%
United Nations Environment Programme	60	9	8%
United Nations Programme for Human Settlement	60	9	8%
<b>TOTAL</b>	<b>740</b>	<b>111</b>	<b>100%</b>

### 3.5 Data Collection Instruments

The study used questionnaires with closed and open-ended questions. With a combination of the questionnaires, interviews and observation, it would be easier to compare and make valid inferences. The study used Likert-type scale rating in the

questionnaires to avoid ambiguity in responding to the questions. Interview sessions, each taking a maximum of 10 minutes also conducted to 50% of the population which is the allowable percentage according to Mugenda & Mugenda (1999). The data was first collected from Kibra residents and then to the other stakeholders.

The study used observation method to collect data on the state of the environment in Kibra slums and the dam area. The data generated was used to compare and confirm the relationship with the information obtained from the interviews and questionnaires. In addition to the above, the study used secondary data that existed from the County Government of Nairobi on the restoration and sustainability programmes during previous restoration attempts to be used as comparative data to make inferences.

### **3.5.1 Pilot Testing**

A pilot experiment was conducted to evaluate feasibility, time, cost, adverse events and effect size in an attempt to predict the appropriate sample size and improve upon the study design prior to performance of a full-scale research project. The test was conducted on members from the target population, but not on those who took part in the final study sample so as not to influence the later behaviour of research subject that had already been involved in the research study.

A sample of 20% from the sampled population of 740 subjects was selected to carry out the pilot experiment. Sampling theory was used to determine the relationship between the samples drawn from the same population and to establish if there was significance difference between two or more samples drawn from the parent population.

### **3.5.2 Validity of Instruments**

According to Stenbacka (2001), the quality of a research is related to the generalizability of the results and thereby to the testing and increasing the trustworthiness or validity of the research. Validity determines whether the research truly measures what it is intended to measure.

According to Saunders et al (2009), before using your questionnaire to collect data, it should be tested. Prior to the data collection, the questionnaire was tested by conducting

a pilot study on Kibra residents and the other dam project stakeholders. The purpose of the pilot study was to check the appropriateness of the language used in the questionnaire as well as determine the quality of the data collected. The researcher then made the necessary adjustments to the instrument to increase the level of its validity.

### **3.5.3 Reliability of Instruments**

Joppe (2000) defines reliability as the extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable. Nachmias and Nachmias (1976) recommended split-half method to measure the reliability of a test to be used. The instruments were split into two subtests during the pilot survey, one consisting of odd numbered items and the other even numbered items. The scores of both groups were computed separately and correlated using the Pearson's product moment correlation coefficient. The results obtained represented the reliability of only one half ( $1/2$ ) of the instrument. The Spearman Brown prophesy formula was then used in order to obtain the reliability of the entire instrument.

$$R_e = \frac{2r}{1+r}$$
 Where  $R_e$  = reliability of scores on total test and  $r$  = reliability for the half ( $1/2$ ) test.

### **3.6 Data Collection Procedure**

The researcher sought permission from the National Commission for Science, Technology and Innovation in order to collect data in the County Government of Nairobi and in NEMA. After receiving the permit, the researcher carried out the pilot survey. After pilot testing, this followed the full survey which started with an initial visit to the County Government and to NEMA to brief on the topic of study and book appointments with Officers directly involved in the restoration of the dam and on environmental issues in general. The questionnaires were distributed personally to the respective respondents and collected a week later. From secondary sources, the study collected information from UNEP and UN-HABITAT reports on the programmes that have so far been undertaken during past dam restoration attempts.

### **3.7 Data Analysis Techniques**

The study used both quantitative and qualitative methods of data analysis. To ensure easy analysis, the questionnaire items were coded according to each variable of the study to ensure the margin of error was minimal and also ensured accuracy of the results.

Descriptive statistics was used to simplify data and to make it more understandable (Gay, 1996). The descriptive statistics utilized percentages frequencies and percentages to analyze the proportions of different elements under the study. Tables were also used to show the relationship between the independent and the dependent variables in the study.

### **3.8 Ethical Issues in Research**

The aim of this research is purely for academic purposes and ensured that a clearance letter to carry out the research was obtained from the relevant Faculty in the University of Nairobi and from the National Commission for Science, Technology and Innovation. The study maintained the integrity and confidentiality of the information received. The study aimed at objectivity and avoided biasness when collecting, analyzing, interpreting and presenting the data collected in order to realize reliable results. The study adhered to the conditions agreed upon with the management of the various institutions where the data was collected for analysis. The researcher strived to avoid ambiguity arising from words with different meanings and long sentences that may have had various interpretations and also strived to avoid careless and grammatical errors that may have resulted to wrong interpretation of data.

### 3.9 Operationalization of Variables

Operationalization defined how each variable was measured, quantified providing a valid index for the independent and dependent variables. Due to the nature of the variables in the study, the measurements use nominal and ordinal values.

**Table 3: Operationalization of the study variables**

Objectives	Variable(s)	Indicator(s)	Measure	Level of scale	Tools of analysis
To examine how stakeholder engagement influences the restoration and sustainability of the Nairobi Dam.	<b>IV:</b> Stakeholder engagement <b>DV:</b> Restoration and sustainability of the Nairobi Dam	<ul style="list-style-type: none"> <li>• Target stakeholders</li> <li>• Project planning meetings</li> <li>• Level of integration</li> </ul>	<ul style="list-style-type: none"> <li>• Number of Kibra residents involved in the dam restoration activities.</li> <li>• Number of project planning meetings held every quarter in a year.</li> <li>• Number of consultations and collaborative activities with stakeholders.</li> </ul>	Nominal	Descriptive
To determine how infrastructure development influences the restoration and sustainability of the Nairobi Dam.	<b>IV:</b> Infrastructure Development <b>DV:</b> Restoration and sustainability of the Nairobi Dam.	<ul style="list-style-type: none"> <li>• Enforcement of legislations and legal frameworks</li> <li>• Installation water sewerage system</li> <li>• Declaration of dam ownership</li> </ul>	<ul style="list-style-type: none"> <li>• Number of legislations enacted to govern the management of water resources.</li> <li>• Number of households with proper sanitation and clean and reliable water supply.</li> <li>• Title deed issued to one management agency.</li> </ul>	Nominal	Descriptive
To establish the extent to which environmental	<b>IV:</b> Environmental Education <b>DV:</b> Restoration and	<ul style="list-style-type: none"> <li>• Organization of training workshops undertaken</li> </ul>	<ul style="list-style-type: none"> <li>• Number of training workshops organized by Nairobi County</li> </ul>	Nominal	Descriptive

Objectives	Variable(s)	Indicator(s)	Measure	Level of scale	Tools of analysis
education influences the restoration and sustainability of the Nairobi Dam.	sustainability of the Nairobi Dam	<ul style="list-style-type: none"> <li>• Mainstreaming environmental education into school curriculum</li> <li>• Accessibility of environmental management information</li> </ul>	<p>Government each year.</p> <ul style="list-style-type: none"> <li>• Number of schools undertaking the environmental curriculum into their programme.</li> <li>• Number of people with access to environmental management information.</li> </ul>		
To assess how organizational management influences the restoration and sustainability of the Nairobi Dam.	<p><b>IV:</b> Organizational Management</p> <p><b>DV:</b> Restoration and sustainability of the Nairobi Dam.</p>	<ul style="list-style-type: none"> <li>• Public Private Partnerships</li> <li>• Water resources management</li> <li>• Alternative livelihood and resettlement plan for informal settlers</li> </ul>	<ul style="list-style-type: none"> <li>• Engagement of a PPP in the implementation of the dam restoration project.</li> <li>• Amount of funds allocated, time and personnel vis-à-vis the level of implementation.</li> <li>• Number of households that have been resettled through slum upgrading and provided with alternative livelihoods.</li> </ul>	Nominal	Descriptive

**Index:** IV – Independent Variable  
DV – Dependent Variable

## **CHAPTER FOUR**

### **DATA ANALYSIS, PRESENTATION, INTERPRETATIONS AND DISCUSSIONS**

#### **4.1 Introduction**

The chapter presents the data analyzed using the research methodology selected and give interpretation. The chapter also discusses the link between the study and other studies that have been discussed in Chapter Two.

#### **4.2 Questionnaire Response Rate**

According to Mugenda & Mugenda (1999), a response of 50% and above is acceptable. The researcher administered 111 questionnaires to the respondents. Out of this, 86 responses were received, constituting a 77% response rate. To increase the return rate, the researcher made frequent reminders to the respondents, assured them that the information would be kept anonymous as it was purely for academic purposes, including extension of deadline for the return of the questionnaire.

#### **4.3 Demographic Characteristics of the Respondents**

The researcher sought demographic characteristics of respondents based on gender, age, the level of education and income, and the information was analyzed and presented in Table 4.



**Table 4: Demographic characteristics of the study population**

<b>Characteristic</b>	<b>Number</b>	<b>Percentage (%)</b>
<b>1. Gender</b>		
Female	36	42.0
Male	50	58.0
<b>Total</b>	<b>86</b>	<b>100</b>
<b>2. Age</b>		
20-30 Years	10	11.6
31-40 Years	37	43.0
41-50 Years	29	33.8
51 Years and above	10	11.6
<b>Total</b>	<b>86</b>	<b>100</b>
<b>3. Educational Level</b>		
Primary level	30	34.9
Secondary level	10	11.6
Tertiary level	46	53.5
<b>Total</b>	<b>86</b>	<b>100</b>
<b>4. Income (Ksh.)</b>		
Less than 5,000	25	29.0
5,001-10,000	11	12.8
10,001-15,000	8	9.3
15,001-20,000	6	7.0
20,001-25,000	4	4.7
25,001 and above	32	37.2
<b>Total</b>	<b>86</b>	<b>100</b>

In Table 4, out of 86 respondents, 36 (42%) were female while 50 (58%) were male, showing clearly that men were more than the women. The proportion for either gender is over  $\frac{1}{3}$  of the total population which is acceptable as per the Kenyan Constitution. The reason for the higher ratio in men was because most of the experts in the County Government, NEMA, UNEP and UN-HABITAT were men, but for Kibra residents, the proportion was relatively equal.

On age level, out of 86 respondents, 10 (11.6%) were within the age of 20-30 years, 37 (43%) were within the age of 31-40 years, 29 (33.8%) were within the age of 41-50 years, and 10 (11.6%) were within the age 51 years and above. The average age is 31-40 years, showing that most of the respondents were middle aged, supported by the theory of normal distribution.

On education level, out of 86 who participated, 30 (34.9%) had primary level of education, 10 (11.6%) had secondary level, and 46 (53.5%) had tertiary level. Given that almost 50% had low level of education (primary and secondary), the issue of restoration might be a challenge. However, noting that 53.5% have tertiary education, it offers some hope in the dam restoration.

On income level, out of 86 study respondents, 25 (29%) earned less than 5,000 Kenya Shillings, 11 (12.8%) earned between 5,001 and 10,000, 8 (9.3%) earned between 10,001 and 15,000, 6 (7%) earned between 15,001 and 20,000, 4 (4.7%) earned between 20,001 and 25,000, and 32 (37.5%) earned 25,001 and above. From the results, it is clear that a large proportion of the population, constituting 62.8% earns 25,000 Kenya Shillings and below. This state of affairs may also pose a challenge in the restoration because majority of the population occupying the riparian land of the dam are within this category, showing that they could be encroaching because life is affordable in the slums. Removing them might pose even a greater challenge.

#### **4.4 Stakeholder Engagement on the Restoration and Sustainability of the Nairobi Dam**

On the influence of stakeholder engagement, one of the indicators was the target stakeholders. It is important to target and include major stakeholders in a project if it is expected to be successful. The second indicator is the number of meeting held with stakeholders to implement the project. This is a determinant factor because no project can be implemented successfully without planning as it involves time, cost and scope. The third is the level of integration of the stakeholders; how they interact, coordinate and work together to implement the project. These are further discussed in detail in the following subsequent sub-themes.

##### **4.4.1 Target Stakeholders**

The empowerment of people at the local level to be able to manage their own water resources is essential. Based on this, the respondents were asked to state whether in their view, the government had engaged all major stakeholders in the dam restoration project and their results are presented in Table 5.

**Table 5: Target stakeholders for dam restoration**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	56	65.1
Disagree	17	19.7
Neutral	0	0.0
Agree	9	10.5
Strongly Agree	4	4.7
<b>Total</b>	<b>86</b>	<b>100</b>

Out of 86 study respondents, 84.8% of the respondents disagreeing confirmed that Kibra residents who were among the major stakeholders in the dam project had completely been left out. 15.4% who indicated that all stakeholders had been involved mentioned that since it would not have been possible to involve everyone, two representatives who were Members of Parliament for Kibra and Lang'ata had been appointed to represent Kibra and Lang'ata residents in the Task Force on the Nairobi Dam Restoration, launched by the Nairobi Governor, Mr. Evans Kidero in 2014. Majority of respondents however felt that this was not adequate as they did not understand the plight of the residents the number was not a sufficient representation of a population of close to 1million people. This poses a major challenge to the restoration and sustainability of the dam.

Further, the respondents agreed that all stakeholders were involved further indicated that government was involving the Kibra residents in clean-ups and waste management control in the slum, in a project launched in 2014 by President Uhuru Kenyatta on water, sanitation and infrastructure development. The project being implemented by the National Government through the National Youth Service had achieved remarkable success and had seen the completion of an access road through the slum, construction of 68 abolition blocks in phase 1, water piping, and waste management projects (separation of waste bins provision and organized collection). The County Government was also working together with Youth Groups in Kibra to collect garbage from the various collection points to the delivery points in exchange of a small fee to motivate them. Another project where residents were engaged was in the waste separation initiative: Waste bags were provided in homesteads and residents advised on how to separate plastics, organic and other wastes into different bags. This is then collected from the waste assembly

points weekly with the help of the Youth Groups and volunteer initiatives. There was also a project for the collection of human waste from homesteads where the residents are provided with two cartridges for each homestead and instructions on how to use is provided. The cartridges are collected daily and used in the manufacture of organic fertilizer. However, the youth groups felt that they had not been fully involved since most of them worked on volunteer basis with little or no pay.

#### 4.4.2 Project Planning Meetings

Engaging stakeholders in planning is a key prerequisite for stakeholders to assume a greater role in the development process. Based on this, respondents were asked to state whether there had been regular planning meetings on the dam restoration and their results are presented in Table 6.

**Table 6: Frequency of project planning meetings**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	46	53.5
Disagree	25	29.1
Neutral	7	8.1
Agree	5	5.8
Strongly Agree	3	3.5
<b>Total</b>	<b>86</b>	<b>100</b>

From the data presented, it is shows clearly 82.6% of respondents were of the opinion that although regular meetings were necessary, they were not been convened and only one meeting was held every quarter or on a needs-basis. They felt that the Task Force had not given priority to the dam project or there could be other underlying issues which could not be disclosed that were affecting the frequency of the meetings held on dam restoration. 9.3% however confirmed that planning meetings were being held quarterly or when necessary. This state of affairs shows laxity and lack of commitment and has implications on the implementation of the dam restoration project.

#### 4.4.3 Level of Integration amongst the Stakeholders

The ability to effectively govern relationships, within and amongst networks as well as with society at large, reinforces an organization's license to operate. Based on this, the respondents were asked to state whether in their view, the government was making efforts to integrate stakeholders working in the dam restoration so as to promote coordination and seamless implementation of the project and the results presented in Table 7.

**Table 7: Integration of stakeholders in promoting coordination**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	34	39.5
Disagree	38	44.1
Neutral	6	7.0
Agree	4	4.7
Strongly Agree	4	4.7
<b>Total</b>	<b>86</b>	<b>100</b>

From the data presented, 83.6% felt that there had not been any efforts by the government to promote integration, posing a challenge to the dam restoration efforts. The integration included encouraging stakeholder participation, motivation and decision-making. 9.4% however, stated that the government had promoted integration since the Task Force was comprised of members from various government departments, and private sector.

#### 4.5 Infrastructure Development on the Restoration and Sustainability of the Nairobi Dam

The indicators for infrastructure development for the restoration and sustainability of the dam included the enforcement of legislations on environmental management, installation of sewerage system in Kibra, declaration of dam ownership and resettlement plan for the informal settlers which are further discussed in the following subsequent sub-themes.

##### 4.5.1 Legislations and Legal Frameworks for Water Resources Governance

Water resources governance refers to the system through which decisions on water are made and enforced. Based on this, the respondents were asked to state in their view, whether the

government was enforcing existing laws and legislations to govern the management and operations of the dam project and the results presented in Table 8.

**Table 8: Institutional of governance in water resources management**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	53	61.6
Disagree	11	12.8
Neutral	3	3.5
Agree	10	11.6
Strongly Agree	9	10.5
<b>Total</b>	<b>86</b>	<b>100</b>

Out of 86 participants, 74.4% of the respondents felt that the existing laws and legislation governing water resources have not been enforced. Majority of the respondents noted that people living in the major cities within the country have the habit of throwing rubbish anywhere, anyhow. Data collected confirmed that the government was in the process of making the Environmental Management Authority Bill into law. Once passed, it is expected that this would help to improve the management and accountability in waste management. Further from the data collected, other related problems within the County Government were seen to be contributing to the problem of waste management. This included the problem of low capacity of personnel in the County Government, ghost workers and old staff who are not yet at the age of retirement but are no longer active and cannot perform physical tasks effectively. The tools and equipment used by the County Government employees are also not adequate to manage the amount of waste emitted especially from informal settlements. Physical planning in Nairobi was also not carried out effectively. There are many buildings coming up, putting a lot of pressure existing old infrastructure.

22.1% however indicated that the laws were enforceable but owing to the Kibra slums was started before the construction of the dam, it is difficult to use force to remove residents and as the population increases, they continue to encroach into the dam area. This poses a major challenge to the implementation of the dam project.

#### 4.5.2 Installation of Sewerage System in Kibra Slums

Effective sewage management is essential for nutrient recycling and for maintaining ecosystem integrity. Based on this, the respondents were asked to state whether in their opinion, the government had plans to install sewerage and waste management system in Kibra and the results presented in Table 9.

**Table 9: Installation of sewerage and waste management system**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	10	11.6
Disagree	12	14.0
Neutral	5	5.8
Agree	19	22.1
Strongly Agree	40	46.5
<b>Total</b>	<b>86</b>	<b>100</b>

68.6% agreed and strongly agreed that the government was indeed already in the process of installing the sewerage system. Majority were already aware of the installation project while those who disagreed did not know the project existed. This looked like a positive step successful restoration and sustainability of the dam. Further in waste management initiatives, data collected confirmed that the Provincial Administration through the National Youth Service had taken up some cleaning activities in the slums, constructed an access road through Kibra, and 68 abolition blocks already completed in Phase 1 of the project. The project was launched by His Excellency, President Uhuru Kenyatta in the year 2014. County Government, the Provincial Administration and other Non-Governmental Organizations were working in collaboration to manage waste and sanitation in Kibra. They have also engaged a lot of youth to assist in waste collection. Projects on human waste collection have also been introduced and these projects are being managed very well, reducing the problem of flying toilets. The County Government plans to also introduce a project on water treatment, later in the year after clearance of the water purifying chemical by the customs since the product has to be imported.

25.6% of the respondents however did not think the government would be concerned with installing sewerage and waste management system in Kibra, an issue that had been there for the longest time.

Further data collected indicated that Dandora dumpsite was created as a temporary location in 1981 but was still in operation up to this day. The dumpsite is now completely overloaded with 1.8meters metric tons of waste. The dumpsite is the only one in Nairobi and is now overflowing with waste and an alternative dumpsite is yet to be sought. Respondents from County Government of the Nairobi confirmed that government had now identified a new dumpsite in Ruai after clearance of land dispute with the Aviation Authorities. The County in collaboration with the Government of Japan was planning to introduce a semi-aerobic landfill method called Fukuoka Method of Waste Disposal, a waste control project, which introduces leachate removal and introduces ventilation to stabilize waste using locally available materials like old drums, tyres, etc. The action plan had already been introduced but funds had not been allocated to commence the project. It is expected that these projects will contribute a great deal in the management and control of solid waste in the city.

#### **4.5.3 Declaration of Dam Ownership**

The safety and security of a dam can affect persons and property across local, state and even national borders. Based on this, the respondents were asked to state whether in their opinion, the County Government had autonomous authority and control in the dam restoration project and the results analyzed in Table 10.

**Table 10: Authority for dam management and control**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	50	58.1
Disagree	20	23.3
Neutral	5	5.8
Agree	3	3.5
Strongly Agree	8	9.3
<b>Total</b>	<b>86</b>	<b>100</b>



From the data presented, 81.4% of the respondents did not think that the County Government had autonomous control of the dam mainly because there had been a lot of political interference with regards to the operation of the dam and the County Government had displayed no powers to counteract this. This could be just one of the reasons why the County Government was not able to undertake its mandate of coordinating the dam restoration. This therefore poses a major challenge in the restoration effort and sustainability of the dam.

Further the data collected, it was noted that the ownership had not only made hard to implement the project but difficult to enforce law and legislation for the dam management. The dam was constructed by the Department of Public Works which was then in the Central Government. However, the Engineers who supervised the construction of the dam were City Council Engineers. Now with the dispensation of the new constitution, it had become even more complicated since the dam had been constructed during the old constitution dispensation. It is currently a tag of war as the Ministry of Lands and Housing, the Nairobi County Government, the Provincial Administration, The Nairobi Water and Sewerage Company all claim the dam ownership. While County Government has currently been mandated by the government to provide technical and administrative role in the management of the dam and the entire river basin, it is still not clear who owns the dam.

Most of the respondents indicated that the lack of clear definition on ownership had also contributed to land grabbing and illegal allocations. For instance, data collected indicated that the Provincial Administration was still allocating land to squatters and there had been massive encroachment in recent times, with some politicians campaigning to have the dam drained to give room for real estate development.

12.8% however indicated that the County Government had control but the Kenyan politics had overshadowed this. Politicians had been seen to insist the locals and residents not to support the dam restoration. This poses a major challenge to the restoration and sustainability of the dam.

#### **4.6 Environmental Education on the Restoration and Sustainability of the Nairobi Dam**

Environmental education is increasingly being recognized as an integral part of the sustainable socio-economic development that is required to achieve equality and a better quality of life. The

indicators identified for environmental education include the training workshops conducted to raise environmental awareness, mainstreaming environmental education into national school curriculum, and making environmental information accessible to the public, as further discussed in the following sub-themes.

#### 4.6.1 Training Workshops to raise Environmental Awareness

It is important to understand the environmental impacts and policies through participation in environmental awareness trainings that produce enduring knowledge and commitment. Based on this, the respondents were asked to confirm whether any trainings or awareness campaigns were being conducted within the country to increase environmental awareness and the results presented in Table 11.

**Table 11: Provision of training workshops on environmental awareness**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	40	46.5
Disagree	31	36.0
Neutral	4	4.7
Agree	5	5.8
Strongly Agree	6	7.0
<b>Total</b>	<b>86</b>	<b>100</b>

Out of 86 participants, 82.5% felt that the government has not made any effort to sensitize the public and other stakeholders on environmental awareness in order to foster environmental-friendly behaviour, and encourage sustainable lifestyles and ethical responsibility. They have not heard or seen any trainings being conducted on environmental awareness.

However, 12.8% felt that the government was making efforts through the County Government which currently has an Environmental Planning and Sensitization section, mandated with the task of informing members of the public about policies of the Council and on waste management. This was justified with responses that NEMA had been undertaking workshops and television advertisements, sensitizing the public on environmental conservation. The only

problem why this has not been very noticeable was due to limited funds and lack of sponsors which seems to translate that the Government had not taken the issue of environmental management seriously. The data collected revealed that the Kenya Institute of Curriculum Development (KICD) was also running a channel on Bamba Television Network on sensitization of the public on environmental awareness. However, from the analysis, most of the respondents indicated they were not aware of such a programme and also by the fact that Bamba TV was still not very popular.

#### **4.6.2 Mainstreaming Environmental Education into School Curriculum**

Teaching of environmental education helps learners to develop positive patterns of behaviour towards the environment. It is based on this that the respondents were as to indicate whether in their view, environmental education and training was currently embedded into the national school curriculum and the results presented in Table 12.

**Table 12: Mainstreaming environmental education into school curriculum**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	20	23.3
Disagree	25	29.0
Neutral	7	8.1
Agree	20	23.3
Strongly Agree	14	16.3
<b>Total</b>	<b>86</b>	<b>100</b>

From the data analysis, 52.3% of the respondents felt that environmental education had not been mainstreamed into the national school curriculum, 39.6% indicating otherwise, thus, it can be deduced the programme exists but has not been given due attention. Environment is only taught as a general course under social studies. This therefore poses a challenge to the dam restoration as it can only reveal that most members of the public are ignorant of their surrounding because they were not sensitized of the importance of environmental management and responsible behaviour from childhood.

Data analyzed confirmed some efforts by NEMA which has developed a curriculum to train the public on environmental conservation practices and is working with KICD and the government to ensure that environmental management is fully streamlined into the national school curriculum. NEMA for instance was able to identify schools along the tributaries of the Nairobi River to help in monitoring the pollution status. The new technique uses the dichotomous key as a way to monitor river-educational awareness and each school has a sample collection point to assess their effectiveness in monitoring. It is being as a pilot project and will be replicated along the whole river system if successful.

NEMA had also embarked on a project called 'green points' a demonstration center where people can get space and exhibit what they like. The rooms use environmental friendly techniques, for example, solar, biogas, water harvesting, among others. The project was started in 6 areas, namely; Embu, Kilifi, Homa Bay, Isiolo, Taita Taveta and Kajiado and would be replicated upon successful implementation. However funds remain a big challenge because the pilot project alone cost approximately 26 million.

The views of respondents are almost 50/50, indicating that much efforts needs to be put to ensure environmental education is fully mainstreamed, otherwise, it poses a major challenge to the restoration and sustainability of the dam.

#### **4.6.3 Accessibility of Environmental Management Information**

Access to information provides a more transparent process on development and environmental issues and gives more legitimacy to environmental decisions by ensuring citizens' rights to participate and promotes accountability. It is based on this that the respondents were asked to state in their opinion, whether the government was availing information on environmental management practices to the public to increase environmental awareness and the results presented under Table 4.13.

**Table 4.13: Accessibility of environmental management information**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	30	34.9
Disagree	31	36
Neutral	4	4.7
Agree	10	11.6
Strongly Agree	11	16.3
<b>Total</b>	<b>86</b>	<b>100</b>

From the presentation in Table 4.13, it is clear that 70.9% do not agree there was adequate access to environmental management information. They also noted that advertisements were very minimal despite the existence of many forms of media for sharing information was noted to be limit due to lack of funds. This, with other underlying causes continues to pose a challenge to the dam restoration and sustainability.

#### **4.7 Organizational management on the Restoration and Sustainability of the Nairobi Dam**

Organizational management happens to have the greatest influence on the restoration and sustainability of wetlands and ecosystems. Indicators under this theme include: engaging in public private partnerships for project implementation, water resources management; and provision of alternative livelihoods and resettlement plan for the Kibra residents encroaching on the dam's riparian land. The indicators have further been discussed in the following sub-themes.

##### **4.7.1 Engaging in Public Private Partnerships (PPPs) for project implementation**

Public Private Partnerships are long-term cooperation agreements between public authority and private sector to provide public service with popular approach to infrastructure development. Based on this, the respondents were asked to state whether they regard PPPs important in the management of public projects and their results were presented in Table 4.14.

**Table 4.14: Importance of PPPs engagement in project management**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	11	12.8
Disagree	13	15.1
Neutral	0	0.0
Agree	30	34.9
Strongly Agree	32	37.2
<b>Total</b>	<b>86</b>	<b>100</b>

From the data analyzed, it is clear that a large majority of respondents, 72.1% support the engagement of PPPs in the dam restoration. The government should consider engaging in private public partnership; take over as the executing agency and leave the implementing role to the private partner. This arrangement would also save the dam from public interference. However, 27.9% did not think the PPPs could manage the dam restoration project since it has a social aspect which includes relocating people many of whom have no alternative homes or livelihoods. They thus felt that the dam project can only be well managed by the government.

#### **4.7.2 Water Resources Management**

The resources consist of people, materials, equipment, knowledge and time, one of the major factors contributing to project failures. Based on this, respondents were asked to state whether in their view, resources for the dam restoration were being put into appropriate use and the results were presented in Table 4.15.

**Table 4.15: Appropriation of project resource for dam restoration**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	42	48.8
Disagree	24	27.9
Neutral	0	0.0
Agree	15	17.5
Strongly Agree	5	5.8
<b>Total</b>	<b>86</b>	<b>100</b>

Out of 86 respondents, 76.7% of respondents felt that the government was not managing the project funds appropriately and there was a lot of corruption involved. They felt that this could have been one of the reasons why the project has not been successfully implemented after four consecutive attempts. They felt that the dam project had stagnated due to insufficient funds although the respondents from the County Government of Nairobi indicated the contrary. 23.3% however felt that the government had good intentions and had so far utilized the allocated funds appropriately. However, there remained the issue of why the project had still not been implemented after three failed attempts.

#### **4.7.3 Alternative Livelihoods and Settlement Plan for Informal Settlers**

Livelihood is a full range of means that individuals, families, and communities utilize to make a living, while resettlement is a process that helps people to build new lives in a different location while mitigating the effects of displacement on their standard of living. Based on this, respondents were asked to state whether in their view, the government had plans to resettle Kibra residents encroaching the dam and also offer alternative livelihood to the dam area farmers and the results were then presented in Table 4.16.

**Table 4.16: Alternative livelihoods and settlement plan for Kibra Residents**

<b>Opinion</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Strongly disagree	40	46.5
Disagree	30	34.9
Neutral	5	5.8
Agree	11	12.8
Strongly Agree	0	0.9
<b>Total</b>	<b>86</b>	<b>100</b>

Data presented in Table 4.16 shows clearly that 81.4% of the study population felt that the government had no plans to offer alternative livelihoods to the dam farmers; neither did it have plans to resettle the squatters who had encroached on the dam area. This could probably be the reason why there is a lot of political interference and resistance from residents who have the fear of being evicted. While 5% were not sure of government's intention, 12.8% trust that the government had good intentions for its citizens and would definitely allocate alternative settlement to the affected and offer opportunities to earn a living. The Nairobi Governor had already announced that rehabilitated dam would occupy 47 acres while remaining 40 acres would be for recreational facilities which it is expected that Kibra residents would be mostly engaged. With this provision, it is possible to engage these residents in alternative livelihood and gain their support to ensure the sustainability of the dam.

#### **4.8 Discussions**

Based on the data analysis, the following discussion make link to other study results on the same subject. The data analysis revealed that stakeholder engagement, and especially community-based was fundamental to the success in the restoration and sustainability of the Nairobi Dam as this would promote accountability, transparency, build trust, partnerships and empowerment. The data analysed was in agreement with Scott (2007) results which pointed out that in engaging communities in community-based sustainability, leadership, planning and communication strategies were crucial and could be achieved through the willingness to identify and engage existing community organizations resources, knowledge and skills. The results were also in line with Gozo (2011) who formed the conclusion that stakeholder institutions involving concerted efforts by all stakeholders led to successful development and sustainability of water resources projects. The results were backed by Borrini-Feyerband (1996), who confirmed that stakeholder engagement promoted collaborative partnership leading to sustained project success.

The data revealed that infrastructure development was fundamental in water resources management. The results were also in agreement with Nellemann (2010), who confirmed that water laws and water rights promoted water resources management and created the remedy for problems of unclear, conflicting and redundant mandates. This was supported by observations made by Taylor (2009), who noted the need to integrate major infrastructure development with an ongoing commitment to community and a driving force to sustainability of projects. The



results of the study were also in agreement with the United Nations Report (2012), which concluded that water stress was a consequence of underdevelopment of infrastructure and that weak water and waste management strategies played a major role in the degradation of water bodies. Further, the analysed data was in agreement with IFAD and GoK Report (2012), affirming that operational climate water flow data collection systems helped to reduce pressure on surface river water use and water body protection from pollution and encroachment.

The analysis also revealed that environmental education was fundamental and helps to create environmental-friendly behaviour, encourages sustainable lifestyles and fosters ethical responsibility. This was backed by UNECE Report (2011) which revealed that capacity building and environmental awareness on international water law and expert management helped to strengthen legal and institutional frameworks for cooperation. The data was supported by Bethune (1996), who formed the conclusion that educating the public about scarce water and wetland resources led to increased awareness and responsible behaviour towards environmental management. In addition, the data is backed by Raburu (2012), who confirmed that capacity building for natural resources management went beyond traditional, top-down approach to enhancing skills and knowledge obtained through training and provision of technical advice to stakeholders.

Further, the analysis revealed that organizational management influenced the restoration and sustainability of wetlands and water bodies. Wenger *et al* (2003) reaffirmed the analysis of data, indicating that governance structures helped to modify the government's water management role and development of policies and plans that addressed basin-wide problems. The analysis also concurred with Desveaux (1994) who confirmed that opportunities to integrate ecological considerations through watershed-based management institutions, conservation planning, increasing water efficiency, improving water reuse and recycling were fundamental aspects of water management. FAO Report (2012) was line with the results, reaffirming that cooperative management of the basin and its shared resources led to improvement of livelihood of people. In addition, basin development planning and management based on shared vision focused on environmental and social economic monitoring programmes, helping to support management decisions and tracking of long-term trends; including promoting of integrated planning criteria and objectives for sustainable development.

## **CHAPTER FIVE**

### **SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter presents the summary of key data findings, conclusions drawn from findings and recommendations made. Further, the chapter outlines recommendations for action based on the findings of the study; and based on the observed study gaps, suggests areas for further study and research.

#### **5.2 Summary of Findings**

This study was carried out to establish the factors influencing the restoration and sustainability of the Nairobi Dam.

##### **5.2.1 Influence of Stakeholder Engagement on Restoration and Sustainability**

The findings revealed that Kibra residents who are primary stakeholders for the dam project by virtue of the fact that they encroached and even farmed in the dam had not been involved in dam restoration project. The government had only engaged the Member of Parliament for Kibra to sit in the Task Force for the Dam Restoration but it was concluded that number was not representative as for a population of close to 1 million people. It was also felt that since the residents would be directly affected by the dam activities, it was necessary to be represented by their own in the restoration programme.

The findings further revealed that the Members of the Task Force for the dam restoration were government appointees running other portfolios concurrently and thus, it would not be possible to fully devote their time to the dam restoration programme. Noting the delay to commence the restoration since the launch in 2014 and the frequency of the meetings; quarterly or on a needs basis, it was also evident that the dam project needed more attention and a more committed team.

In addition, the findings revealed that youth groups had also not been involved in any of the previous restoration efforts that the Government had so far undertaken. It was only in the slum

clean-up exercise launched by President Uhuru Kenyatta in 2014 that they engaged as volunteers and when lucky would get something small.

On the level of integration, the findings revealed that the Task Force on the dam restoration project was still in the storming stage and there were a lot of divergent views. Political interference had also had an effect on the level of integration. There was also noted political interference, with the dam area has taking a political dimension, noting that members of some communities were continuing to flood and settle in the area despite the ongoing plan to rehabilitate the dam.

### **5.2.2 Influence of Infrastructure Development on Restoration and Sustainability**

The findings revealed that although there existed legislations safeguarding wetlands and Environmental Management Acts, these have not yet been enforced.

Further, the findings revealed that there was increased pressure on old infrastructure due to the rise in population and unstructured building plans. First of all, Kibra itself had not been planned and with rising population, this had led congestion and water and sanitation issues. The ‘throw away’ habit of wastes by the City residents had only made the situation worse.

In addition the findings revealed that conservation and management of wetlands was still a major challenge in Kenya. Due to the fact that most of these natural ecosystems were found in unprotected area, they faced the risk of encroachment or being reclaimed for infrastructure and real estate development.

Findings further revealed that the County Government of Nairobi was facing serious challenges in waste management. Firstly, the County has low capacity of personnel and old staff, unable to perform manual tasks but could not be sent home until they attained retirement age. Secondly, there was the problem of ghost workers. The County was also facing challenges due to inadequate tools and equipment that relied on old technology to manage wastes.

The findings also showed that there had not been a sewerage system in Kibra slums, resulting to dumping of waste. Luckily, President Uhuru Kenyatta had launched a project in 2014 for slum upgrading, water and sanitation. The new project had seen the construction of a sewer which was

now 75% complete including access road, piped water and waste management. This had also seen the involvement of youth groups in major activities, providing a source of livelihood. The project started changing the polluted state of Kibra but for the river basin system and the dam, a lot remains to be done.

The findings also revealed that the restoration of the dam could not be singled out and needed to be incorporated with the river system since it forms the Nairobi river basin. The restoration also needed to be connected with water and sanitation, including resettlement plan for the residents of Kibra who had encroached on the dam area. Politicians also needed to separate their politics from the management of the dam.

As the findings indicated, an alternative dumpsite in Ruai had been explored and was expected to help in waste management control as the current one in Dandora was chocking with waste, approximately 1.8metres over the allowable capacity. It was confirmed that the County Government in collaboration with the Japan Government was also planning to introduce, a semi-aerobic landfill waste management method called 'Fukuoka method of waste disposal' which would involve leachate removal and ventilation to stabilize gas emissions and was environmental friendly and affordable because it used locally available materials like used car tyres, water drums, among others.

As per the findings, the ownership of the dam could still not be confirmed. The dam was being claimed by the County Government of Nairobi, the Ministry of Lands and Housing, the Nairobi Water and Sewerage Company, the Provincial administration, among others. For instance, although the government had mandated the restoration of the project to the County Government as the lead in dam restoration and control, the Provincial Administration was still allocating leases to informal settlers, the latest cases being in early 2015, noting that over 10 acres of the dam area had already been occupied.

### **5.2.3 Influence of Environmental Education on Restoration and Sustainability**

From the findings, it was confirmed that the government had not been conducting training workshops on environmental management and awareness-raising. Though the County Government of Nairobi had an Environmental Planning and Sensitization Section, much was yet

to be realized on the side of environmental management awareness due to limitation on funds. The County however defended itself and indicating that there was an Environmental Management Authority Bill 2014 that was in the process of being made into law and it was expected to hold individuals personally responsible for littering of wastes, noting that most of the city residents had a 'dumping' culture and dropped litter on the ground even when dustbins were provided.

Further, the findings revealed that NEMA played supervisory and coordination role in environmental management issues within the country. There was an indication that NEMA was undertaking intensive environmental campaigns and training workshops, including television advertisements. This was however being done on a small scale due to limitation of funds. The findings also showed that the Kenya Institute of Curriculum Development was running a channel on Bamba Television on environmental awareness. However, not many people were aware that such a programme existed.

Further, the findings showed that little had been done by the government to mainstream environmental education into the national school curriculum. The data also revealed that the County Government was planning to introduce environmental management into schools as it was in charge of childhood education.

In addition, the data confirmed that NEMA was developing a curriculum piloting schools along the tributaries of the Nairobi River that uses dichotomous key technique to monitor pollution status of river. Findings revealed that NEMA had also created information centers in all counties through and had entered into an agreement with the Kenya National Libraries to share and distribute information on environmental management but not many were aware of this service. Findings further confirmed that NEMA had embarked on a project called 'green points' a demonstration centre where people obtained space to exhibit environmental friendly techniques e.g., biogas, solar, rainwater harvesting, etc. The pilot project had already started in Embu, Kilifi, Homa Bay, Isiolo, Taita Taveta and Kajiado. Cost implications were however a major drawback to the successful implementation of the project which is expected to cost the government approximately 26 million.

Further, the findings revealed sharing of information on environmental management to increase awareness was still being done on a very small scale. For instance, few flyers on separation of waste had been produced by the County Government due to limitation of funds. Findings also showed that the County Government was also noted to be making efforts to engage Ward representatives to be in charge of sensitizing the citizens on environmental management but still, funding sources and low capacity of personnel remain the greatest challenges.

#### **5.2.4 Influence of Organizational Management on Restoration and Sustainability**

Findings revealed that although the County Government had been mandated to take the lead in the dam restoration, there was still a lot of interference from Politicians and this was allowed to go on unnoticed resulting to derailment in the dam implementation project. A good example is seen from the way Provincial Administration continued to issue leases to squatters to occupy the riparian land of the dam while at the same time the County Government was making plans to commence the rehabilitation of the dam.

Further, the findings revealed that although the government was partnering with other international UN agencies like UNEP and UN-HABITAT, the construction and management of the dam was solely in the hands of the County Government. The government therefore had not explored the option of engaging in public private partnership to co-implement the project despite the fact that this has proved to be one of the best ways to implement public projects. In addition, the findings revealed that the management of resources had at a great deal influenced the dam restoration project. With corruption being seen to be engraved in government offices, there remains a challenge on the effective utilization of project funds and PPPs are seen to offer a solution.

The findings revealed that most of the respondents felt that government had no plans to offer squatters alternative livelihood and resettlement scheme in order to vacate the dam area. Most of them fear eviction and this has resulted to resistance, violence and a lot of political interference. Further, the findings revealed that since the previous slum upgrading had not received much success, there was need to devise a new strategy that incorporated provision of livelihood to afford the new lifestyles.

### **5.3 Conclusions**

Based on the analysis of the study, it is evident that the factors influencing the restoration and sustainability of the Nairobi Dam project were partly due to failure to involve all major stakeholders in project implementation, less frequent project planning meetings and disintegration within the Task Force on the dam restoration; on infrastructure development, it was concluded that the Government had not enforced the existing legislations on water resources management, water sewerage system had not been in existence in Kibra slums although finally the construction and installation work was in progress and dam ownership had not been declared. It was also conclusive that environmental education had not been given due attention. This was proved by the fact that organization of training workshops and environmental awareness campaigns were hardly conducted, environmental education had not yet been mainstreamed into the national school curriculum, and environmental information was still not adequately accessible. On organizational management, the findings led to the conclusion that the government had not engaged PPPs in the dam restoration efforts to assist in the management of the project, the project resources were not being put into intended and appropriate use and it was still not clear whether the government had attained sufficient funds to fully implement the project; and the government was not willing to resettle the slum dwellers and provide them with alternative livelihoods.

It is intended that this research will serve as a guide and information tool to be used by the government and the results of the study would be replicated to other similar situations and similar projects.

### **5.4 Recommendations**

Based on the findings of this study, the following recommendations were suggested:

1. The County Government is encouraged to engage all major stakeholders in the dam restoration project to promote accountability, transparency, build trust, partnerships and empowerment. It is recommended the County Government reinvents its planning strategy to increase the frequency of planning meetings from quarterly and make them regular with reports to monitor progress, identify loopholes and seek remedy in good time before the commencement of the project. It is also advisable that the Governor of Nairobi

reconsiders the composition of the Task Team to ensure it comprises a committed team, most of them from the County Government because it is mandated to oversee the implementation of the dam restoration project.

2. The government should have laws and legislations that define accountability. It should also issue a title deed to one government body to ensure autonomous control and protection from political interference. The County Government should consider restructuring its human resource in order to employ more and energetic staff member to undertake manual tasks that have been left in the hands of old staff. A handshake should be reconsidered to retire the old and staff members who are no longer productive in their respective functions and the government should consider allocating more funds to support the County Government operations from its budget for environmental management and water resources infrastructure. The government should also declare dam ownership in order to give autonomy to a sole owner and increase accountability and responsibility.
3. Training workshops to increase environmental awareness should be intensified as they tend to create new environmental-friendly behaviour; encourage sustainable lifestyles and foster ethical responsibility. Mainstreaming environmental education into national school curriculum is essential, not only to bring up responsible citizens aware of their surroundings but also to promote sustainable development. Government should devise a means of bringing environmental information closer to the people and intensify media campaigns to cultivate responsible behaviour.
4. The County Government should also consider engaging PPPs as implementing agency and the County to work as executing agency with defined roles and authority. This kind of relationship arrangement has been seen to lead to better management of project resources in addition to successful implementation of projects. In order to ensure sustainability of the project, the government should consider providing the residents who farm in the dam alternative livelihood, including employing them in the recreational facilities that will be constructed with dam project.



### **5.5 Suggestion for Further Research**

The study recommends that further research be conducted in similar water catchment areas to define whether the results of this study are representative and address the common challenges that are encountered in these water bodies.

Further research is recommended on the how eviction or resettlement of the Kibra resident could have on their livelihood and on the dam restoration and sustainability.

Due to the delimitations of the study, the research only concentrated on the dam area and did not further investigate on the situation of the Nairobi river system which is felt could also be a major contributing factor to the current polluted state of the dam apart from the waste that is emitted from Kibra slums.

## REFERENCES

- Best, J.W., (1970). *Research in Education*. Englewood Cliffs, NJ: Prentice-Hall.
- Bethune, S., (1996). *Namibia's Challenge Sustainable Water Use*. Namibia Environmental Issue Volume 1: 185-189.
- Borrini-Feyerband, G (1996). *Collaborative management of protected areas: Tailoring the approach to the context*. IUCN, Gland, Switzerland.
- Callaway, J.M., et al, (2009). *Benefits and Costs of Measures for Coping with Water and Climate Change: Berg River Basin, South Africa*, London publishers.
- Desveaux, J.A., (1994). *Anticipating Uncertainty: The Strategy-Structure Problem in Public Bureaucracy Governance*, London Publishers.
- Dukhovny, V.A. (2000). *Water Governance and Management – Theory and Practice*. McMillan Publishers.
- FAO Report (2012). *Managing Africa's Water Resources: Integrating Sustainable use of Land, Forest and Fisheries*. ISSN-1:2026-5611.
- Nachmias, C., and Nachmias, D.,(1996). *Research Methods in the Social Sciences (5<sup>th</sup> edition)*. St. Martin's Press, New York, USA.
- Gerlak, A.K., and Schemeyer, S., (2014). *Climate Change and Transboundary Waters: A study discourse in the Mekong River Commission*. University of Arizona, Tucson, USA.
- Gozo, E.N., (2011). *Stakeholders' participation in water resources planning and development: A roadmap to the sustainability of Mutasa Dam in Ward 6 of Buhera North, Zimbabwe*. ISSN: 1520-5509.
- IFAD Report (2006). *Viet Nam Country strategic opportunities programme*. Document EB/2008/94/Rev.1, Rome, Italy.
- IFAD and the Government of Kenya (2012). *Impact Assessment Report: Mount Kenya East Pilot Project*, prepared by Capital Strategies Kenya Ltd.
- IFC (2007). *Stakeholder engagement: A good practice handbook for companies doing business in emerging markets*, Longman Publishers.

- Joffe, S., and Cooke, S., (1997). *Management of the water hyacinth and other invasive aquatic weeds: Issues for the World Bank*. The World Bank, Washington DC.
- Joppe, M. (2000). *The Research Process*. Retrieved February 25, 1998:  
<http://www.ryerson.ca/mjoppe/rp.html>.
- McClain, M., (2014). *Improving Safety and Security in the Mara River Basin: Sustainable Water Initiative, Mau Mau Serengeti*. Report by the UNESCO-IHE Institute for Water Education and Wide World Fund for Nature.
- Mehtonen, K., Keskinen, M., & Varis, O., (2008). *The Mekong: IWRM and Cooperation between different institutions*, Springer, Berlin/Heldelberg. In. Press.
- Mensah, K.B., (1996), *Water Law, Water Rights and Water Supply (Africa)*. Ghana Study Country Report, Silsoe, International Development, pg. 28.
- Mugenda, A., and Mugenda (1999). *Research Methods: Quantitative and qualitative approaches*, Nairobi Act Press.
- Namale, B.D., (2013). *Nairobi Dam: Daunting Task to Rehabilitate Water Reservoir*, Jassem ISSN 1119-8574.
- Nellemann, C., (2010). *Dead Planet – Biodiversity and Ecosystem Restoration for Sustainable Development: A Rapid Response Assessment*. UNEP and GRID-Arendal. Printed by Birkeland Trykkeri AS, Norway. ISBN: 978-82-7701-083-0.
- Odongo, M.O., and UNEP Report (2013). *Restoration Plan on Restoration of the Nairobi Rivers and the Restoration of the Nairobi Dam*, ISBN 987-92-807-3289-6.
- Pinsonneault, A., and Kraemer, K.L., (1993). *Survey research methodology in management information systems*. An assessment: *Journal of management information systems*, pages 10, 75-105.
- Philip, R., et al (2008). *Understanding the Context – The Role of local government in Integrated Water Resources Management* by ICLEI Publishers.

- Raburu, P.O., Okeyo-Owuor, J.B., Kwena, F., (2012); *Community Based Approach to the management of Nyando Wetlands, Lake Victoria Basin, Kenya*, First Edition by McPowl Media Ltd.
- Rahaman, M.M., & Varis, O., (2005). *Integrated Water Resources Management: Evolution, Prospects & Future Challenges*. Sustainability: Science, Practice & Policy, Article Vol. 1 Issue 1.
- Saunders N.K., Phillip Lewis and Adrian Thornhill (2009). *Research Methods for Business Students*, Pitman Publishers.
- Sham, C., et al (2002). *DNA Pooling: A tool for large-scale association studies*. National Revision Genet.3:862–871.
- Scott, K., (2007). *Engaging Urban Communities: Six Case Studies of Auckland Community-Based Restoration Project*.Landscape Research Institute, Auckland, New Zealand.
- Simeoni, G., et al (2000). *Trends of pollutant indicators and mass balances in tropical hydropower reservoirs*.Hydro 2000 Conference Proceedings, International Journal of Hydropower and Dams, 409-416.
- Stenbacka, C., (2001). *Qualitative Research requires quality concepts of its own*. *Management Decisions*, 39 (1), 551-555.
- Taylor, R., (2009). *Towards a systems-based approach to planning infrastructure*.ISBN 785-1-284927-294-6.
- UN Report (2012). *The Future We Want: Resolution 1 outcome document of the United Nations Conference on Sustainable Development*, Rio de Janeiro, Brazil.
- UNECE Report (2011). *Strengthening Water Management and Trans-boundary Water Cooperation in Central Asia: the Role of UNECE Environmental Conventions*. Printed by United Nations, Geneva.

- UNEP Report (2004). *A new initiative to restore the Nairobi Dam and its Waters back to health*. ISBN No. 978-92-807-2075-2.
- UNEP Report (2007). *Innovation for sustainable development: Local case studies from Africa*, ISBN No. 978-92-807-3310-5.
- UNEP Report (2008). *Managing Urban Sewage: An Introductory Guide for Decision-Makers*. The Journal on Freshwater Publication issue 21.
- Wangui J., (2014), *Fourth attempt to clean up Nairobi Dam*. Capital Press Article No.3
- WCD Report (2000). *Dams, ecosystems function and environmental restoration*. WCD Thematic Review, Environmental Issues II, Earthscan Publications Ltd., London.
- WCD Report (200). *Kariba Dam: Zambia and Zimbabwe*. [Http://www.dams.org](http://www.dams.org)
- Wenger R., Rogger, C., and Datch, S.W., (2003). *InfoResources Focus Journal No.1 Series 3*.
- Yatich T., et al (2009). *Challenging conventional mindsets and disconnects in a conservation: The emerging role of eco-agriculture in Kenya's landscape mosaics*. World Agroforestry Centre 2009, ICRAF Working Paper no. 83.

## APPENDICES

P.O. Box 47074, 00100  
Nairobi

8 April 2015

Dear Respondent,

**Re: Letter of Transmittal for Data Collection Instruments**

My name is Julia Wangui Rugo. I am a student at the University of Nairobi, undertaking a Master of Arts Degree in Project Planning and Management. The purpose of this research is in fulfillment and requirement for the Award of the degree.

To assist in undertaking the research, I have identified you as a respondent in answering research/interview questions for my research study. The information collected is for academic purposes only and will be kept confidential.

I therefore seek your cooperation to be able to successfully undertake this research.

Yours faithfully,

Julia Wangui Rugo

**Introduction Letter from the University of Nairobi**

## Letter of Permit



## Questionnaire

The views provided in this data sheet are for academic purpose alone and will be kept confidential.

### Section 1-A: Personal Information

My name is Julia Wangui Rugo. I am a student at the University of Nairobi, undertaking a Master of Arts Degree in Project Planning and Management. The purpose of this research is in Partial fulfillment and requirement for the Award of the degree. The information collected is for academic purposes only and will be kept confidential.

### Section 1-B: Personal Details

Name (Optional).....Gender:.....Age (Range).....

Level of income:.....

Occupation:.....Monthly income (Range):.....

**TOPIC: FACTORS INFLUENCING THE RESTORATION OF THE NAIROBI DAM,  
NAIROBI COUNTY**

**Section 2: Questions**

Select the most appropriate choice for your answer. Please indicate by ticking in the box with an X or ✓

**Key:** (5) SA-Strongly agree; (4) A-Agree; (3) N-Neutral; (2) Disagree; (1) SD- Strongly disagree.

**1. Stakeholder Engagement**

- The County Government has engaged all major stakeholders in dam restoration project.

SA     A     N     D     SD

- The stakeholders meet frequently to plan on the dam project implementation with provision of progress reports.

SA     A     N     D     SD

- The government has made efforts to integrate stakeholders in order to promote coordination.

SA     A     N     D     SD

**2. Infrastructure Development**

- The government has enforced existing law and legislations governing water resources.

SA     A     N     D     SD

Please evidence to support your answer:

-----  
-----  
-----

- The County Government has installed a sewerage and waste management system in Kibra slum area.

SA     A     N     D     SD

If not, how do residents manage both solid and liquid waste?

-----  
 -----  
 -----

- The County Government has autonomous control on the management of the dam.

SA     A     N     D     SD

### 3. Environmental Education and Training

- Training and awareness campaigns are conducted to increase environmental awareness.

Give reasons to support your answer.

○ \_\_\_\_\_  
 ○ \_\_\_\_\_  
 ○ \_\_\_\_\_

- Environmental education and training is currently in the national school curriculum.

SA     A     N     D     SD

Give evidence to support your answer.

○ \_\_\_\_\_  
 ○ \_\_\_\_\_  
 ○ \_\_\_\_\_

- The government provides environmental management information to its citizens through various media avenues.

SA     A     N     D     SD

Give evidence to support your answer.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

#### 4. Organizational Management

- Public Private Partnerships are important in the implementation of public projects.

SA     A     N     D     SD

Give reasons to support your answer.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

The government has involved other partners in the forefront for the dam restoration. If so, give reasons to support your answer.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

- The government has appropriated resources for the dam restoration with transparency and accountability measures.

SA     A     N     D     SD

- Give reasons to support your answer:

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

## **Interview Questions**

### **Stakeholder engagement:**

- Who are the major stakeholders in the restoration of the dam? Are Kibra residents involved? If not, why is this so?
- What is the significance of planning meetings and what is the frequency?
- What is the composition of the stakeholders? What would you say about their level of integration?

### **Infrastructure Development**

- Are you aware of any laws and legislations governing water management resources? Do you think they have been enforced? Why and why not?
- What are the existing Acts of Parliament that protect natural resources from depletion and exploitation?
- What is the status of the sewerage system in Kibra and how do residents manage waste?
- Are there any plans in place to improve the sanitation situation in Kibra?
- Do you know who owns the dam? Would you say the County Government has autonomous control on the dam management and operations?
- There are plans by the government to resettle the slum residents when the dam project commences.

### **Environmental Education**

- Has the government been conducting environmental awareness trainings and workshops to Kibra residents and the public in general?
- Do you think environmental education has been emphasized in the institutions of learning, starting from primary schools?
- What kind of information is shared and through what media on environmental management?
- What forms of information materials are being used to increase environmental awareness? Please mention the various forms of information sharing tools used.

### **Organizational Management**

- What is the influence of the Member of Parliament with respect to the dam restoration on the residents of Kibra?
- What is the role played by the County Government of Nairobi on the dam restoration?
- How do you think the resources for the dam project are managed? Do you think this could be one of the reasons for project failure and unexplained delays?
- What plans are there by the government to ensure residents have an alternative livelihood after relocation from the dam area?

## State of the Nairobi Dam

1) Between 1953 and 1990



2 a) Now



2 b)



2 c)

