WATER RESOURCE MANAGEMENT TOOLS, MONITORING AND EVALUATION AND SUSTAINABILITY OF PROJECTS IN NYANGORES RIVER SUB-CATCHMENT BASIN IN BOMET COUNTY, KENYA

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Thesis Submitted in Partial Fulfillment of the Requirements for the Award of the Degree of Doctor of Philosophy in Project Planning and Management, (Monitoring and Evaluation Option) Faculty of Business and Management Science, University of Nairobi

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DECLARATION

This thesis is my original work and has not been submitted for any award in any University.

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DEDICATION

I dedicate this study to my beloved grandma, Taprobkog Chebo Kipchabas, for her relentless support and inspiring wisdom of the aged that has shaped my view and perspective in life, and in education.

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TABLE OF CONTENT

Page No.

DECLARATION ..... **ii**
DEDICATION ..... **iii**
ACKNOWLEDGEMENT ..... **iv**
TABLE OF CONTENT ..... **v**
LIST OF TABLES ..... **xii**
LIST OF FIGURE ..... **xv**
LIST OF ABBREVIATIONS AND ACRONYMS ..... **xvi**
ABSTRACT ..... **xvii**
CHAPTER ONE **1**
INTRODUCTION **1**
1.1 Background of the Study 1
1.1.1 Sustainability of Projects 4
1.1.2 Monitoring and Evaluation 5
1.1.3 Water Resource Management Tools 5
1.1.3.1 Enabling Environment. 5
1.1.3.2 Institutional Structures 6
1.1.3.3 Management Instrument 6
1.1.3.4 Infrastructure Development 6
1.1.4 Nyangores River Sub-catchment Basin 7
1.2 Research Problem 7
1.3 Purpose of the Study 8
1.4 Objectives of the Study 9
1.5 Research Questions 9
1.6 Research Hypotheses 10
1.7 Significance of the Study 10
1.8 Delimitations of the Study 11
1.9 Limitations of the Study 11
1.10 Basic assumptions of the Study 11
1.11 Definitions of Significant terms as used in the Study 12

1.12 Organization of the Study 13
CHAPTER TWO 14
LITERATURE REVIEW 14
2.1 Introduction 14
2.2 Sustainability of Projects in River Sub-catchment Basin 14
2.3 Water Resource Management Tools and Sustainability of Projects 19
2.4. Enabling Environment and Sustainability of Projects 24
2.5. Institutional Structures and Sustainability of Projects. 31
2.6. Management Instruments and Sustainability of Projects in River Sub-catchment Basin 36
2.7 Infrastructure Development and Sustainability of Projects in River Sub-catchment Basin ... 44
2.8 Monitoring and Evaluation and Sustainability of Projects 48
2.10 Theoretical Framework 56
2.10.1 Game Theory 56
2.11 Conceptual Framework 57
2.12 Summary of Literature Review 59
2.13 Knowledge Gaps 61
CHAPTER THREE 71
RESEARCH METHODOLOGY 71
3.1 Introduction 71
3.2 Research Paradigm 71
3.2.1 Research Design 72
3.3 Target Population 73
3.4 Sample Size and Sampling Procedure 74
3.4.1 Sample Size 74
3.4.2 Sampling procedure 74
3.5 Research Instruments 76
3.5.1. Pilot Testing of Research Instruments 78
3.5.2 Validity of Research Instruments 78
3.5.3 Reliability of Research Instruments 81
3.6 Data collection procedures 82
3.7 Data Analysis Technique 82

3.7.1 Quantitative Data Analysis. 83
3.7.2 Qualitative Data Analysis 83
3.7.3 Inferential Analysis. 83
3.7.3.1 Correlation analysis 84
3.7.3.2. Regression Analysis 86
3.7.4 Tests of Research Hypotheses 89
3.8 Ethical Considerations 92
3.9 Operationalization of variables 92
CHAPTER FOUR 98
DATA ANALYSIS, PRESENTATION, INTERPTRETATION AND DISCUSSION 98
4.1 Introduction 98
4.2 Questionnaire Return Rate 98
4.3 Background Information of the Respondents 98
4.3.1 Distribution of Respondents by Gender 99
4.3.2. Distribution of Respondents by sub county of Residence. 100
4.3.3. Distribution of Respondents by Length of Stay in the WRUA Basin. 100
4.3.4. Distribution of Respondents as per Roles Played 100
4.4 Diagnostic Tests 101
4.4.1. Test for Normality of Research Data 101
4.4.2. Multicollinearity Test 102
4.4.3. Linearity Tests 104
4.4.4. Likert Scale as a Measure 104
4.5. Sustainability of Projects in Nyangores River Sub-catchment Basin 105
4.6 Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin 111
4.6.1 Correlation Analysis of Enabling Environment and Sustainabilty of Projects in Nyangores River Sub-catchment Basin 117
4.6.2 Regression Analysis between Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin. 118
4.6.2.1 Model Summary of Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin. 119

4.6.2.2 Analysis of Variance of Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin. 120
4.6.2.3 Coefficients for Enabling Environment on Sustainability of Projects in Nyangores River sub-catchment Basin. 120
4.7 Institutional Structures and Sustainability of Projects in Nyangores River Sub catchment Basin 121
4.7.1 Correlation Analysis Between Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin 127
4.7.2 Regression Analysis Between Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin. 128
4.7.2.1 Model Summary of Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 128
4.7.2.2 Analysis of Variance for Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 129
4.7.2.3 Coefficients of Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 130
4.8 Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin. 130
4.8.1 Correlation Analysis of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin 136
4.8.2 Regression Analysis Between Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin. 137
4.8.2.1 Model Summary of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin. 138
4.8.2.2 ANOVA of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin. 138
4.8.2.3 Regression Coefficients of Management Instruments and Sustainability of Projects in Nyangores river basin. 139
4.9. Infrastructure Development and Sustainability of Projects in Nyangores river basin. 140
4.9.1 Correlation Between Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin 144

4.9.2 Regression Analysis Between Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin. 146
4.9.2.1 Model Summary of Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 146
4.9.2.2 Analysis of Variance of and Infrastructure Development Sustainability of Projects in Nyangores River Sub-catchment Basin..... 147
4.9.2.3 Coefficients of Infrastructure Development and Sustainability of Projects in Nyangores River Sub-Catchment Basin..... 147
4.10 Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin..... 148
4.10.1 Correlations Analysis of Combined Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment basin..... 149
4.10.2 Regression Analysis of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin..... 150
4.10.2.1 Model Summary of Combined Influence of Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 150
4.10.2.2 ANOVA of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin. 151
4.10.2.3 Coefficient of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-Catchment Basin ... 152
4.11 Monitoring and Evaluation on the Sustainability of Projects in Nyangores River Sub-catchment Basin. 153
4.11.1 Correlation Analysis of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 159
4.11.2 Regression Analysis between monitoring and evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 160
4.11.2.1 Model Summary of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 160
4.11.2.2 Analysis of Variance of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 161

4.11.2.3 Coefficients of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin 162
4.12 Moderating influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin 162
4.12.1 Correlations Analysis of Moderating Influence of Monitoring and Evaluation on the relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment basin 164
4.12.2 Regression Analysis of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-Catchment Basin. 166
4.12.2.1 Model Summary of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin 167
4.12.2.2 ANOVA of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-Catchment Basin 168
4.12.2.3 Coefficient Regression of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-Catchment Basin.. 168
CHAPTER FIVE 171
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS 171
5.1. Introduction 171
5.2. Summary of Findings 171
5.2.1. Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin. 171
5.2.2. Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin. 172
5.2.3. Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin 172

5.2.4. Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin 173
5.2.5. Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin 174
5.2.6. Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin 174
5.2.7. Moderating influence of Monitoring and Evaluation on the Relationship between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin 175
5.3. Conclusions 176
5.4. Recommendations 177
5.4.1. Recommendations for Policy 177
5.4.2. Recommendation for Practice 178
5.4.3. Contribution of the study to the body of knowledge 179
5.5 Suggestions for Further Research 179
REFERENCES 181
APPENDICES 190
APPENDIX I: Transmittal Letter 190
APPENDIX II: Questionnaire for The Household Leaders 191
APPENDIX III: Interview Guide for Ministries of Agriculture and Water and Natural Resource Officials. 198
APPENDIX IV: Interview Guide for Wrua/Wrma Respondents 199
APPENDIX V: Checklist for Document Analysis 201
APPENDIX VI: Water Resource Authority (WRA) South Rift 202
APPENDIX VII: National Commission for Science, Technology and Innovation, (NACOSTI), Research License 203
APPENDIX VIII: Map of Nyangores Sub-Catchment Basin 204
APPENDIX IX: Krejcie and Morgan (1970) 205

LIST OF TABLES

Table 2.1: Knowledge Gaps 61
Table 3.1: Target Population 73
Table 3.2: Stepwise sampling procedure 76
Table 3.3: The number of experts and the implication the acceptance cut-off score of CVI. 79
Table 3.4: Ratings on a 10-item scale by 4 experts on a 4-point relevance scale. 80
Table 3.5: Reliability Statistics 82
Table 3.6: Summary of Research Hypotheses Tests 90
Table 3.7: Operational Definition of Variables 93
Table 4.1: Background Information of the Respondents 99
Table 4.2: Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests 102
Table 4.3: Collinearity Statistics 102
Table 4.4: Correlation Matrix for Independent Variables 103
Table 4.5: Sustainability of Projects in Nyangores River Sub-catchment Basin 106
Table 4.6: Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin 112
Table 4.7: Correlation Analysis of Enabling Environment on Sustainability of Projects in Nyangores River Sub-catchment Basin 118
Table 4.8: Model Summary of Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin. 119
Table 4.9: ANOVA of Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin 120
Table 4.10: Coefficients of Enabling Environment on Sustainability of Projects in Nyangores River sub-catchment Basin. 120
Table 4.11: Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin. 122
Table 4.12: Correlations Results Between Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin 127
Table 4.13: Model Summary of Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin 128

Table 4.14: ANOVA of Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin 129
Table 4.15: Model Coefficient for Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin 130
Table 4.16: Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin. 130
Table 4.17: Correlations Results Between Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin 137
Table 4.18: Model Summary of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin. 138
Table 4.19: ANOVA of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin. 139
Table 4.20: Model Coefficients for Management Instruments and Sustainability of Projects in Nyangores river basin. 139
Table 4.21: Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin. 140
Table 4.22: Correlation Between Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin 145
Table 4.23: Model Summary of Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin 146
Table 4.24: ANOVA for Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin 147
Table 4.25: Model Coefficients of Infrastructure Development and Sustainability of Projects in Nyangores River Sub-Catchment Basin. 148
Table 4.26: Combined Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin 149
Table 4.27: Correlations Results between Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment basin 150
Table 4.28: Model Summary of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin. 151

Table 4.29: ANOVA of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin. 151
Table 4.30: Coefficient of Combined influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin. 152
Table 4.31: Monitoring and Evaluation on the Sustainability of Projects in Nyangores River Sub-catchment Basin 154
Table 4.32: Correlation Analysis of Monitoring and Evaluation on Sustainability of Projects in Nyangores River Sub-catchment Basin..... 159
Table 4.33: Model Summary of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 160
Table 4.34: ANOVA of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin 161
Table 4.35: Model Coefficients of Monitoring and Evaluation and Sustainability of Projects in Nyangores river basin..... 162
Table 4.36: Moderating influence of Monitoring and Evaluation on the Relationship Between Water resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin. 163
Table 4.37: Correlation Analysis of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 165
Table 4.38: Model Summary of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 167
Table 4.39: NOVA of Moderating Influence of Monitoring and Evaluation Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-Catchment Basin 168
Table 4.40: Coefficients of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin..... 169
Table 5.1: Contribution of the study to the body of knowledge 179

LIST OF FIGURE

Figure 1: Conceptual Framework. 58

LIST OF ABBREVIATIONS AND ACRONYMS

AMCOW	African Ministers' Council on Water.
CAAC	Catchment Area Advisory Committee
EU	European Union
IRB	Inkomati River Basin
IWRM	Integrated Water Resource Management
KNBS	Kenya National Bureau of Statistics (M. Al-Damkhi S. A.-W.-N., 2009)
KTDA	Kenya Tea Development Association
LVBC	Lake Victoria Basin Commission
M&E	Monitoring and Evaluation
MDG's	Millennium Development Goals
MEEM	Monitoring and Evaluation for Ecosystem Management
NEMA	National Environmental Management Authority
RBO	River Basin Organization
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
WASH	Water, Sanitation and Hygiene
WCP	World Congress of Philosophy
WR	Water Resource
WRMA	Water Resource Management Authority
WRUA	Water Resource Users Association
WSP	Water Service Partnership
WSS	Water Supply Strategy
WUA	Water User Association

ABSTRACT

Water resources can be successfully managed only if the natural, social, economic and political environments, in which water occurs and used, are taken fully into consideration, coupled with regular monitoring and evaluation. Integrated basin management approach has been applied in Nyangores River sub-catchment basin since the year 2009 but with minimal success. Sub catchment degradation, organizational weakness, the flow and quality of water had started to diminish, creating challenges for local livelihoods, wildlife in the Maasai Mara Game Reserve, and failure to sustain biodiversity and healthy ecosystem functioning. The study intended to make significant contribution towards the management of projects in a river basin that raise the sustainability of the sub-catchment. The study aimed to establish the influence of water resource management tools, Monitoring and Evaluation on the sustainability of projects in Nyangores River Sub-Catchment Basin. The objectives of the study were; to establish the extent to which enabling environment influence sustainability of projects in Nyangores River sub-catchment Basin, to determine the extent to which institutional structures influence sustainability of projects, to examine the extent to which management instruments influence sustainability of projects, to establish the extent to which infrastructure development influence sustainability of projects, to examine the combined influence of water resource management tools on sustainability of projects, how Monitoring and Evaluation influence the sustainability of projects in Nyangores river sub-catchment basin and to determine the moderating influence of monitoring and evaluation on the relationship between water resource management tools and sustainability of projects in Nyangores River subcatchment Basin. The research designs used were descriptive survey and correlational research design. The sample size was 381, from a targeted a population of 56508 household heads. Questionnaires, Interview guide and document analysis were used for data collection. Stepwise and purposive sampling formed the sampling procedure. Descriptive and inferential statistics were used in the analysis of the data. For parametric data, stepwise regression was used. Pearson's product moment correlation coefficient were used to analyze the linear relationship between independent variables and dependent variables. The results are presented descriptively using Tables. For qualitative data, narrative statements were used. All the null hypotheses were rejected at $p=0.000<0.05$ and the conclusion was that there is a significant relationship between each of the independent variables, and sustainability of projects in Nyangores river sub-catchment basin. Recommendations are; ensure a stringent policy for robust planning and management, and more robust forum for the stakeholders to complement the efforts of WRUA. It is suggested for further research, similar studies are done for the other adjacent river basins and to investigate ways of raising the level of community participation in the basin.

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

A drainage basin or catchment basin is any region of land where precipitation gathers and depletes off into a typical outlet, for example, a stream, cove, or other waterway. The bowl incorporates all the surface water from downpour spillover, snowmelt, and close by streams that run downslope towards the mutual outlet catchment bowls, which thusly channel into another normal outlet. The catchment bowl goes about as a pipe by gathering all the water inside the region secured by the bowl and diverting it to a solitary point, (Virginia Department of Conservation and Creation, 2012) It incorporates all the environments that exist inside the bowl, for example, mountains, timberlands, forests, wetlands, pastures, horticultural zones and even urban fixations.

Water planning, improving governance and building institutional capabilities are powerful social instrument for obtaining growth, poverty reduction and environmental benefits, (Atef, 2014). Since the Earth Summit, held in Rio de Jenairo, Brazil, the global focus for the environment as a whole, encompassing the water environment, is that progress ought to be made towards sustainable development, (Howarth, 2013). It can be argued that sustainable development, is one that meets the needs of the present without compromising the ability of future generations to meet their own needs, however, leaves unanswerable questions about what precisely would the future generations prefer to inherit by way of environmental goods and developmental benefits, (Howarth, 2013), Nonetheless, this conveys a general sense that a forward-looking balance is critical between environmental, social, and economic factors in making contemporary decisions, from major developmental projects to matters of individual lifestyle choice. This concurs, regardless of the ultimate success in promoting the concept of IWRM, and communicates to stakeholders that water decisions require broad and the promotion of shared values, such as conservation and the alleviation of poverty, (Grigg, 2008).

Land use and freshwater are rarely managed in concert, although inextricably linked. The uses of land and water in the upper section can affect water use and communities downstream, the converse is true. Such linkages are often seen in a watershed view, but not always fully taken into account, practically, when responses are being developed at the various levels of the local, national

and international levels. To raise the chances of achieving such objectives demands consideration of a catchment management approach in the planning, monitoring and implementation of forest, water resource, agricultural and even in urban development programs. Excessive nutrient loads have led to the poor biological condition in over than 30 percent of the Nation's stream ways, in United States, and up to 20 percent of the Nation's lakes and reservoirs, according to U.S. Geological Survey, (EPA, 2006).

An assessment undertaken in Yellow River, China, found that river sustainability should be developed to include the river system's interconnected physical, biological and socio-economic wellbeing functions. Process Analysis Method, (PAM), provided the guidelines for establishing the assessment framework and selection of indicators. It involved the stakeholders at various stages of the assessment, who are well placed to share on the emerging issues and pay adequate attention to sustainability impacts, ((Wu, Darton and Borthwick, 2016). Sustainability assessment in the Yellow river, using the tailored indicator set, revealed the trade-offs between the three categories of sustainability: social wellbeing, environmental performance and economic status. The assessment provided the policy-makers and river planners with a holistic perspective of the river basin. The framework monitors the progress towards sustainable development and assists to identify priorities during multi-faceted decision-making for an integrated river basin planning and execution.

Further, many countries from the Human Development Index, HDI, have managed to recognize acceptable impacts on the environment. These included; Mexico, Swaziland, Mauritius and Germany, in addition, decreasing rates of ecosystem degradation were notable in; Malawi, Netherlands and Portugal. The most frequently desirable environmental change is a rise in water quality, commonly as a product of a well done waste water treatment. This has been witnessed in various countries that include; Brazil, Rwanda, Bahamas, Sweden, Latvia, Tonga, Andorra, Azerbaijan, Ireland and Belgium. Where efforts have been undertaken with a view to adapt the national climate change measures, flood and drought have consequently been prevention or at least managed as result indicated a number of countries including Korea, Cuba, Portugal, Malaysia and Ghana among others, (UNEP, 2012).

African Ministers Council's on Water, (2012), AMCOW, did a survey on the development, management and use of water resource and the overall impression is that there is good progress but a great deal of work remains to be done to strengthen the enabling environment for water resources management. Policies, laws, and plans are in place in many countries but are still in the earlier stage of implementation in most sub-regions except for North Africa. The lack of these enabling instruments are raised as constraints by many countries and the reasons why 25 % of countries have not yet started to apply a water law and 50 percent is lack of management instrument, in particular the management plan.

In spite of such a great potentials of water resources, the people of Ethiopia in the basin have, so far, benefited minimally. However, the management of the water resource is affected by several hindering factors; therefore, the region is under water stress, while having a great water resource potential. People are still lacking water in the basin in spite of this great water resources. Further, the large proportion (65%) of steeply slope and land degradation, together with lack of water resource infrastructure and innovation (81.9%), have paused major challenges. While on the other hand, recreational use of water in the area is also common with several sites famous for its waterfall. In addition, the dams were used as spot for fishing, through which local community members participate in fishing activities for food and income generation, (Yericho, Berhanu and Meshesh, 2019).

Degradation of water resources, over-abstraction of surface water in some parts of Kenya, inappropriate land use changes, soil erosion in catchments, and deterioration of riparian lands causing flash floods, turbidity, and siltation of water courses and storage facilities have led to serious degradation in the quantity and quality of the water resources. The dramatic reduction in the depth of Lake Baringo, from over 15 meters in 1921 to an average of 1.8 meters today is due not only to reduced inflows but also to the increased sediment load from surrounding unprotected and degraded catchments. The Poverty Reduction Strategy Paper (PRSP) recognizes that water is a basic need and an important catalyst for both economic and social development of the country. It asserts that, access to water for human consumption, agriculture, and livestock use is a major problem in rural areas, (Yericho, Berhanu and Meshesha, 2019). It is, thus, paramount to improve the living standards of the rural communities through the provision of sustainable water resources

and used productively. The overall objectives in the formulation of the National Water Resource Management Strategy (NWRMS) are to achieve, equitable access to water services, sustainable use of water resource, and efficient and effective water use for optimum social and economic benefit.

The Nyangores River sub-catchment covers an all-out region of 696 Km2 in Bomet and Nakuru districts with an expected populace of 300,000. The elevations inside sub-catchment change from 2951m around the sources in the Mau Escarpment to 1706m downstream in Kaboson. The measure of precipitation changes as indicated by these elevations. The Mau Escarpment gets most precipitation with a mean yearly precipitation somewhere in the range of 1,000 and 1,750 mm. Nyangores River begins from the Nyangores timberland (Mau Complex) and runs south east for around 94 km before joining Amala River at Kaboson to frame the principle Mara River. There are two boreholes inside the bowl, which are lawful. These are Kipsigis Sacco at Bomet Town and Itembe/Kapkwen. Different sources incorporate four (4) dam, 13 container and around 1,500 unprotected springs inside the sub catchment, (UNDP , 2012). The Nyangores sub-catchment is to a great extent sloping in geology with half of the complete region over the elevation of 2202m. There is one useful waterway measuring information station inside sub-catchment to be specific (1LA03) at Bomet and there is a precipitation station at Bomet Water Supply Station. The bowl is enriched with a lot of water sources with a normal progression of 8.6
m3/s at 1LA03. Dolomite and calcite are the significant stone sorts in the upper and center pieces of the sub-catchment, which bolster various groundwater springs, both profound and shallow. The significant soil types are the cambisols, portrayed by basic steadiness, high porosity, great water maintenance and moderate to high fruitfulness, thus reasonable for rural exercises, (UNDP , 2012).

1.1.1 Sustainability of Projects

The projects include the planting of trees on riparian land, hill tops and to promote river bank and springs protection under agroforestry practices. Removals of blue gum from river banks and replace them with fruit trees to provide alternative sources of livelihoods and to enhance the financial capacity of the members under income generating activities. In addition, projects to improve water quality for both domestic and natural ecosystem use as well as to enhance soil and water conservation in the catchment under waste management practices and wastewater treatment

as well as to promote enforcement of legal requirements, (USAID, 2011) . In broad terms, sustainability implies the provision of more efficient services that maintain public health and welfare, that are cost-effective, without negative environmental impacts, today and into the future, (Halla, 2017)

1.1.2 Monitoring and Evaluation

Monitoring involves the routine checking of information on progress, to confirm that the program or a given project is occurring as per the defined direction. It is often done on monthly to quarterly reporting, on outputs, activities and use of resources such as people, time, money, and materials. It is done to ensure that what has been planned is going forward as intended and within the resources allocated. Meyer, (2002), on the other hand agrees that evaluation is used to ensure that the direction chosen is correct, and that the right mix of strategies and resources are in use to realize the set objectives. Typically, it can be formative, helping to develop learning and understanding within stakeholders, pre-project, done at various stages in the middle of the project, or summative at the end, indicating the degree of achievement, focusing on outcomes and their relationship with outputs.

1.1.3. Water Resource Management Tools

This refers to a set of technical, institutional, managerial, legal and operational conditions and activities required to plan, develop, operate and manage water resources in the rivers, lakes and underground. Enabling environment, Institutional structures, Management instruments and Infrastructure development constitute the water resource management tools.

1.1.3.1 Enabling Environment.

The Enabling Environment comprises the policies, legislative framework, financing, peaceful coexistence, sectoral coordination and political tranquility in Water Management. A more precise definition of the enabling environment can be the policy and financial framework that is necessary for sustaining and replicating large-scale programs, WSP, (2015)

1.1.3.2 Institutional Structures

Riordan, (1999), defined institutions as the multitudes of means for holding society together, for giving it a sense of purpose, and for enabling it to adapt. Young, (2004), explained institutions to mean collection of rights, rules, and decision-making procedures governing human actions in specific issue areas. The acts of creation, rather than processes of discovery become important in the refinement of institutions. Communication, culturally ascribed values, and patterns of status and association, show-socialised ways in institutions, (Riordan, 1999), Institutional roles involves creating organizational framework in various forms and functions, river basin and building institutional capacity by developing human resources, (IWRM, 2010).

1.1.3.3 Management Instrument

Management instruments comprise of Economic strategies that are part of the water managers' policy toolbox of marginal cost pricing, water markets, emission taxes and subsides, (Atef, 2014) .They are incentives to modify individuals' behaviour in order to meet the goals of a green economy in a predictable way, such as by reducing water consumption, eliminating pollution, increasing water saving and avoiding water losses and to generate revenues to fund water management and water related infrastructure. Effectively management instruments generate behavior change towards more efficient water use, stringent enough to encourage innovation, compatible with legal and institutional framework, stable enough to give security to investors, politically acceptable and implementable at a low monitoring and enforcement cost. In addition, Atef, (2014), cautions that such management instruments should be adopted on the basis of their ability to contribute to specific water policy objectives, including targets related to economic efficiency, social equity and environmental preservation.

1.1.3.4 Infrastructure Development

Water infrastructure is critical to vital sectors of the economy such as energy, transportation, food, and health. These infrastructures include dams, levees, irrigation systems, water treatment plants, water retention swales and ponds, potable water supply network and tanks, and manmade as well as natural aquifers, reservoirs, among many. Realizing the importance of water infrastructures, efforts have already begun on understanding the resilience of these systems under a changing climate due to planetary scale global warming using climate projection data.(Hossain, Arnold,

Beighley, Brown, Burian,Chen. 2015). The information coming from the majority of countries in Africa suggests that there is yet little evidence of a fully integrated approach to infrastructure development although awareness is increasing, (UN Water, 2012).

1.1.4 Nyangores River Sub-catchment Basin

The Nyangores River sub-catchment covers an all-out region of 696 Km2 in Bomet and Nakuru districts with an expected populace of 300,000. The elevations inside sub-catchment change from 2951m around the sources in the Mau Escarpment to 1706m downstream in Kaboson. There are two boreholes inside the bowl, which are lawful. These are Kipsigis Sacco at Bomet Town and Itembe/Kapkwen. Different sources incorporate four (4) dam, 13 container and around 1,500 unprotected springs inside the sub catchment, (UNDP , 2012). The Nyangores sub-catchment is to a great extent sloping in geology with half of the complete region over the elevation of 2202m.
The bowl is enriched with a lot of water sources with a normal progression of 8.6 m3/s at 1LA03. Dolomite and calcite are the significant stone sorts in the upper and center pieces of the sub-catchment, which bolster various groundwater springs, both profound and shallow. The significant soil types are the cambisols, portrayed by basic steadiness, high porosity, great water maintenance and moderate to high fruitfulness, thus reasonable for rural exercises, (UNDP , 2012).

1.2 Research Problem

Water Resource Management approach is arranged to co-ordinate improvement and the management of water, land and related asset for venture supportability so as to boost the resultant monetary and social government assistance in an even handed way without bargaining the manageability of essential biological systems, (GWP, 2012). To pursue this target, Kenya has just moved to a River Basin Management approach through the establishment of the Water Act 2002 which gave the legitimate system to the executives and improvement of water assets, (UNEP , 2012)

Nyangores River Sub-catchment is the sole basin in Bomet in which, integrated basin management approach has been applied since the year 2009. However, minimal success has been realized in the sustenance of the basin projects. Nyangores Water Resource Users Association(WRUA), a community based organization in collaboration with Water Resource Management

Association(WRMA), is still increasingly facing numerous problems that may be summed up to include those resulting from sub-catchment degradation and organizational weakness. The flow and quality of water has started to diminish creating challenges for local livelihoods with adverse effects on the health and wealth, threat to wildlife in the Maasai Mara Game Reserve, and jeopardize the sustenance of biodiversity and healthy ecosystem functioning, (UNEP , 2012)

The enabling environment, institutional structures, management instruments and infrastructure development constitute the water resource management tools, for the sustainability of agroforestry, water supply, income generation and waste disposal methods as projects in a River Basin Management approach. Up to now evaluations have, in many cases, failed to account for sustainability concerns. Videira, (2009), all agree in their studies that the evaluation procedure of new plans and projects must evolve into a new, multi-dimensional and multi-stakeholder participatory approach. Where monitoring has been done, it has revealed that limitations in our conceptualization of the basin may reduce the likelihood of achieving the basin scale objectives. (Gawne, 2018). It is on the basis of this background that the study intends to assess the influence of water resource management tools on the sustainability of projects in Nyangores River sub-catchment basin.

1.3 Purpose of the Study

The purpose of the study was to establish how water resource management tools influence sustainability of projects in Nyangores River Sub-Catchment Basin in Bomet County, Kenya. The study also sought to establish the moderating influence of Monitoring and Evaluation on the relationship between water resource management tools and sustainability of projects in Nyangores River Sub-catchment basin in Bomet County, Kenya.

1.4 Objectives of the Study

The study aimed and achieved the following objectives:

i). To establish the extent to which enabling environment influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.

ii). To determine the extent to which institutional structures influence sustainability of Projects in Nyangores river sub-catchment basin in Bomet county, Kenya.

iii). To examine the extent to which management instruments influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.

iv). To establish the extent to which infrastructure development influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.

v). To examine the extent to which the combined water resource management tools influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.

vi). To assess how monitoring and evaluation influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.

vii). To determine the moderating influence of monitoring and evaluation on the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.

1.5 Research Questions

The study sought and answered the following research questions;

i). To what extent does enabling environment influence sustainability projects in Nyangores river Sub-catchment basin in Bomet, Kenya?

ii). To what extent does institutional structures influence sustainability of projects in Nyangores river Sub-catchment basin in Bomet, Kenya?

iii). To what extent does management instruments influence sustainability of projects in Nyangores river Sub-catchment basin in Bomet, Kenya?

iv). To what extent does the infrastructure development influence sustainability of projects in Nyangores river sub-catchment basin in Bomet, Kenya?

v). To what extent do combined water resource management tools influence sustainability of projects in Nyangores river sub-catchment basin in Bomet, Kenya?

vi) How does Monitoring and Evaluation influence the sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya?

vii). To what extent does monitoring and evaluation moderate the relationship between water resource management tools and sustainability of projects in Nyangores river Sub-catchment basin in Bomet, Kenya?

1.6 Research Hypotheses

The study sought and tested the following research hypotheses:

H_{01}: There is no significant relationship between enabling environment and sustainability of projects in Nyangores river Sub-catchment basin in Bomet, Kenya.

H_{02}: There is no significant relationship between institutional structures and sustainability of projects in Nyangores river Sub-catchment basin in Bomet, Kenya.

H_{03}: There is no significant relationship between management instruments and sustainability of Projects in Nyangores river Sub-catchment basin in Bomet, Kenya.

H_{04}: There is no significant relationship between infrastructure development and sustainability of projects in Nyangores river Sub-catchment basin in Bomet, Kenya.

H_{05}: There is no significant relationship between the combined water resource management tools and sustainability of projects in Nyangores river sub-catchment basin in Bomet, Kenya

H_{06}: There is no significant relationship between Monitoring and Evaluation and sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.

H_{07}: The strength of the relationship between the water resource management tools and sustainability of projects in Nyangores river sub-catchment basin in Bomet does not depend on monitoring and evaluation.

1.7 Significance of the Study

The significance of this study was its contribution to the lessons relevant to the country's river basin management approach planning, implementation and evaluation. The study also provided a basis for policy and institutional sector reforms for river basin management system in Kenya. In addition it provides a guide to the prioritization of investments in infrastructure for capacity development. To contribute to the need for improved water governance and for increased coordination and collaboration among various water sectors, such as drinking water supply and

sanitation, irrigation and ecosystem sustenance. The study sets the basis for the formulation and operationalization of more stringent policy for robust planning and management, and more robust forum for the stakeholders to complement the efforts of WRUA.

1.8 Delimitations of the Study

The study was delimited to only two sub-counties, Bomet Central and Chepalungu in Bomet County where river basin management approach has been actively practiced for over five years now. This is where Nyangores Water Resource Users Association, (WRUA) is fully functional with registered members. Nyangores River Basin was the only one in this region and critical for the sustenance of Maasai Mara Game reserve, Lake Victoria basin and consequently the Nile basin. Further, this is where environmental challenges in regard to soil degradation, lack of water catchment protection and inadequate waste disposal mechanisms are experienced.

1.9 Limitations of the Study

The limitation in regard to low literacy level of some respondents, was resolved by the use of well-trained and locally drawn research assistants able to interpret and translate precisely using simple language in guiding instruments. To overcome accessibility challenges, various modes of mobility and transport were employed, such as access by foot or motor bikes where appropriate, carrying out activities in earnest to take advantage of the presence of any available, favorable opportunity. The study was not funded, consequently took longer time than scheduled, the researcher however, provided adequate funds and engaged trained assistants to save on time and optimize the quality of the study. In the event of records lacking from the relevant local institutional sources, linkages to appropriate external sources via internet or telephone interview was done in addition to triangulation of respondents' opinions.

1.10 Basic assumptions of the Study

The basic assumptions in the study were; that the water resource management tools play a significant role in water resource management; that the WRUA members and the user community together with all the stakeholders were motivated enough to actively engage in water resource management activities. Further, that funds and technical capacities were provided to carry out the water resource management functions; that the respondents were available and willing to give

honest and up to date response for this study; that records were available and accessible to the researcher and that the research assistants would be able and capable of undertaking a worthwhile data collection.

1.11 Definitions of Significant terms as used in the Study

The terms used within the context of the study, intended to convey the following meaning as explained in each case:

Enabling Environment: The conditions favourable for the implementation of the management processes for water resource in the river basin. Comprises the policy operations, political goodwill, advocacy and sensitization programmes and financing.

Infrastructure Development: The endeavors undertaken to put in place physical facilities and structures that conserves the quality and quantity of the natural resources within the basin. Comprise Slope stabilization practices, maintenance of water pans, water storage facilities, damping sites and waste treatment plants.

Institutional Structures: The humanly devised constraints and facilities that shape human interaction including the institutional hierarchy and organization, culturally ascribed values and level of human training.

Management Instruments: These are the methods and elements intended to modify an individual behavior in the choice of actions towards the sustenance of the water resource in the river basin, comprising of the management plan, water pricing mechanism, rate of water payment receipt and level of financial incentives.

Monitoring and Evaluation: The routine collection and analysis of information about the implementation and progress of a given water resource management tool in the basin, and the episodic review of the milestones in relation to the established objectives. These are Availability of M&E plan, availability of M&E results, rate of M&E approach review and M&E trained staff.

River Sub-Catchment Basin: Designate morphological area from which rainwater flows into a single watercourse or a river, and published in the Gazette notice by the concerned Cabinet Secretary.

Sustainability of projects in Nyangores River Sub-Catchment Basin. The ability of the basin projects, agroforestry practices, soil conservation measures, human health and wellness, income generating initiatives and waste disposal to continuously meet the needs of the basin population.

Water Resource Management Tools: The set of technical, institutional, managerial, enabling environment, management instruments and infrastructure development meant to facilitate the development and management of land, water and other related resource.

1.12 Organization of the Study

This research thesis is organized in five chapters. The first chapter covers introduction to the study, under which, are the background and the problem the study sought to pursue. The purpose of the study, research objectives, research questions and the hypotheses of the study are explained. Then the significance, delimitations, limitations, basic assumptions and definition of significant terms in the study are examined. In chapter two, the theoretical and empirical literature are examined thematically. Enabling environment and sustainability of projects in river sub-catchment basin, institutional structures and sustainability of projects in river sub-catchment basin, management instruments and sustainability of projects in river sub-catchment basin, infrastructure development and sustainability of projects in river sub-catchment basin, and monitoring and evaluation and sustainability of projects in river sub-catchment basin. The conceptual framework to model the relationship between the independent and dependent variables. Theoretical framework and summary of literature as well as knowledge gaps ends the chapter. Chapter three covers the research paradigm and design, the target population, research instruments, sample size and sampling procedures. Data collection procedures and data analysis technique before the Ethical considerations and operationalization of variables.

Chapter four of the study presents the data analysis, presentation, interpretation and discussion based on the study objectives. Chapter five gives the summary of the study findings, conclusions, recommendations, contribution to the body of knowledge and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature related to the study based on the following thematic areas: Sustainability of projects in River sub-catchment basin. Water resource management tools and sustainability of projects in River sub-catchment Basin. Enabling environment and sustainability of projects in River sub-catchment basin, Institutional structures and sustainability of projects in River sub-catchment basin, Management instruments and sustainability of projects in River sub-catchment basin, Infrastructure development and sustainability of projects in River sub-catchment basin. Monitoring and evaluation on sustainability of projects in River sub-catchment Basin, Theoretical framework, conceptual framework, summery of literature and knowledge gaps.

2.2 Sustainability of Projects in River Sub-Catchment Basin

In this section, a review of empirical literature is done on the projects sustainability that included agro-forestry, income generating engagements, waste disposal mechanisms and soil and water conservation methods. A study by, Chumbulla and Ally, (2018), on the job of neighborhood organizations in the production of an empowering domain for water venture supportability in Iringa District, Tanzania depended on a cross - sectional research configuration to permit information to be gathered at a solitary point in time. The plan took into account the expressive investigation, translation, just as assurance of connections between factors. Three towns were arbitrarily chosen inside Iringa Rural District. The rule for town choice was accessibility of a water venture. Sixty (60) families which were profiting by the task were arbitrarily chosen to make a sum of one hundred and eighty (180) families. Nine key witnesses, six from the town level and three from the area level were utilized to gather subjective information to enhance the data which was gathered through perception and organized poll overviews. Double calculated relapse model was utilized to decide the elements for the supportability of the ventures. The outcomes uncovered that about 93% of the respondents knew about the town by-laws and guidelines for ecological security. Just 6.7% of the respondents didn't know about these by-laws and guidelines. When the center gathering conversation were approached to clarify what may be the reason for impracticality of water asset extends in the region coming up next was the reaction. 'individuals are simply difficult, no one in our town can say that he/she isn't educated about the presence of by-laws

overseeing water asset use… . the main test is that we can't refer to the particular guidelines… … we generally be cognizant once we do anything around water sources'.

Agro-biological systems are natural practices oversaw by networks over a wide scope of fields to create food, feed for domesticated animals and fiber. Largely, human practices shape environmental elements and elements of characteristic procedures that happen in agro-biological systems. As agroecosystems communicate with characteristic biological systems in agrarian scenes, spread harvests that improve maintainability of the agro-environment traits may likewise by implication improve characteristics of neighboring normal biological systems. Ranchers world over decide to develop explicit spread yield types and to oversee them with a particular goal in mind dependent on their own exceptional needs and objectives. The last are impacted by natural, ecological, social, social and financial variables of the food framework which ranchers work, (Snapp, 2005). Agro-ranger service in Kenya depicts land use frameworks where trees are developed in relationship with agrarian harvests fields or domesticated animals - and there are generally both biological and monetary collaborations between segments of the framework. Ranchers have drilled agroforestry for a considerable length of time. Agro-ranger service as a land use framework in which trees and bushes are developed in relationship with crops in a similar land unit, can possibly capture land corruption and provincial destitution of dry grounds through assistance and creation capacities.

Different agroforestry advances have had gigantic application and have lifted many out of destitution just as moderating declining agrarian efficiency and common assets. Remarkable models are manure trees, for example, Calliandra species, Leucena and others which when joined with inorganic composts improves the harvest yields in corrupted terrains. So also, grain trees utilized in smallholder zero-touching frameworks to enhance or substitute business takes care of and improved assortments of mild and tropical natural products that are utilized to enhance family unit wages and nourishment, (Jama, Evasu and Magosti, 2006). Furthermore, therapeutic trees that are used on ranch and preserved in-situ and quickly developing timber and fuel trees that can be developed in different areas inside the homestead or in business woodlots and manors. To accomplish this objective, the key difficulties that must be tended to incorporate gracefully of value seedlings, responsive augmentation benefits particularly at province level, and enactment on

arrangements that give sufficient impetuses to interests in planting trees and normal asset the executives, and access to business sectors through improved frameworks. In numerous regions, the greater part of the natural products delivered wind up spoiling in the field because of these mishaps. Conventional agroforestry frameworks appear as trees dissipated on crop fields, woodlots, estate tree planting and multi-story home nurseries. This framework requires pruning trees of branches and tops to lessen concealing. The administration elements of trees are various and incorporate improving soil richness, moderating soil dampness and improving smaller scale atmosphere bringing about expanded harvest yields, (Jama, Evasu and Magosti, 2006).

Ojang, (2014)), in an examination on Farmers' Sustainable Strategies for Soil Conservation on Sloping Arable Lands in the Upper Yangtze River Basin, China, utilized quantitative techniques to explore the feasible Strategies for Soil Conservation on Sloping Arable Lands in the Upper Yangtze River Basin, China. Soil redistribution rates were evaluated by contrasting the reference esteem and the inventories for testing locales utilizing adjustment models, while soil redistribution on developed slanting grounds was likewise measured by attractive following. The basic incline length for the commencement of rills on slanting arable terrains was dictated by rehashed counterfeit precipitation reenactments on test overflow plots with focused angles, and the outcomes are factual midpoints with the chance of reoccurrence. Changing over the straight slope inclines to inconsecutive level patios was one of the many soil protection quantifies under the national activity of Soil Conservation in the Upper Yangtze River Basin. The investigation by, Ojang, (2014), found that dirt disintegration rate is firmly identified with neighborhood geography that is incline length and inclination, while patios demonstrated viable in forestalling sheet and rill disintegration by shortening the slant length and diminishing the slant angle. Be that as it may, local extraordinary rainfalls throughout the late spring season and thought spillovers will in general lead to the flimsiness of the patio structures (skirting on breakdown) and, subsequently, brings about a high measure of soil misfortune, accordingly, the upkeep of the porch structure and its capacities requires a lot of steady work and money related speculation.

The United Nations predicts that 1.8 billion individuals will encounter supreme water shortage in under 5 years, and stress that by 2025, two out of three people will be living in water-focused on districts. Effectively every five people worldwide can't get to their essential ordinary water asset,

a reality as of late saw in Cape Town, South Africa which is in desperate need of water with genuine proportioning of the ware. Poor administration of assets, for example, spontaneous land clearing for development and deforestation of the water towers has prompted genuine natural and biological corruption just as decreased water volumes. Soil and water preservation programs have picked up acknowledgment on the planet as methods for water the board, (Gleick, 2009). Soil and land the board practices, for example, culturing and editing rehearses, straightforwardly influence the general soil disintegration issue and arrangements on a ranch. At the point when crop turns or shifting culturing rehearses neglects to control disintegration on a field, it requires a mix of approaches as a need. These are frequently sorted as; Agronomic, for example, plant or soil spread that is preservation cultivating techniques and form cultivating. Vegetative, for example, planting hindrances or strips, live fences and windbreaks. Auxiliary, for example, Fanya Juu, patios, banks, bunds, cut off channels, obstructions and in conclusion, generally the board, for example, territory terminations and particular clearing, (Ojang, 2014),

In a study to Identify Factors Affecting the Sustainability of Water Environment Treatment Public-Private Partnership Projects in China, Huimin Li, Qing Xia, Shiping Wen, Lunyan Wang and Lelin Lv1, (2018), used various approaches that included structured interviews among the industry professionals, sustainability literature review, and survey based on questionnaire for indicator validation, done for a two-month period with a response rate of approximately 62%. In the study, water treatment projects involved social projects, that included sewage treatment, ecological repair, and landscape vegetation cover; such assets require professional knowledge, and therefore, guaranteed efficiency while fully depending on the government is quite difficult. Sustainability is perceived through the three lenses of economic, social and environmental aspects, often referred to as the triple bottom line. In this regard, sustainability of deliverables tied with the delivery processes is crucial as they often come with remarkable social and ecological impacts, (Kivila, Martinsuo, and Vuorinen, 2017). Increasing number of developing countries are faced with water deficiency, for various reasons such as scarcity of natural water resources, populace increase, rising standards of living, and poorly developed infrastructure supply. Water sustainability is critical for both humans and environmental health, (Al-Damkhi, Abdul-Wahab, and Al-Nafisi, 2009).

Water deficiency, if not addressed in a prompt and sustainable manner, will result in inevitably adverse effects on socio-economic and ecological development, (Almedeij, 2007). The study found that sustainable development of public waste water projects can be achieved by ensuring full-cost pricing and taking into account the external costs from wastewater services. Reducing the drinking water consumed, again through the reuse and recycling of unconventional sources of water, has been noted as one of the goals of sustainable development. It evaluated and contrasted the environmental impacts attributed to the use of water supply from sources such as rainwater and gray water recycling, which provided alternatives to the traditional sources, via the comprehensive use of life-cycle assessment and hydrological modeling. Factors for the sustainability of water environment treatment were identified. Among them, the economic sustainability dimension. The sustainable cash flow, as an indicator was ranked as the most important one since any project that lacks cash flow, cannot guarantee the financial resources needed in establishment and operation leading to a non-conducive condition. Furthermore, appropriate management of water pollution can increase the value of lands and the project and promote area-wide economic development, (Huimin Li, *et al*, 2018). The study concluded that a sustainable water treatment PPP project must not only ensure that the treatment technology used is sustainable but also avoid damage to the natural environment. To confirm the factors that influence the sustainability of water treatment PPP projects, a sustainability evaluation indicator system was constructed from the five dimensions. The leading indicator from the five dimensions was the economy, referring to the sustainable cash flow, followed by the society, to mean, public satisfaction, then resources and environment that meant the effect on water quality, engineering referred to the renewal of project facilities and project management to represent the structure of management organization.

A study was done to define and measure river basin sustainability: a case study of the Yellow River by, (Wu, Darton and Borthwick, 2016). Broad fieldwork was done to conduct stakeholder interviews and collect comprehensive data. The assessment was done to provide policy-makers and river decision makers with a detailed review of the river basin that could be used as a basis for integrated river basin management articulation. The Yellow River is divided into three stages: the upper, middle and the lower Reaches of the Yellow River. The Lower Yellow River is known as the suspended river, due to accumulation of sediment which has raised the river bed to an average of 5m higher than the surrounding ground on both banks. The River basin stands at the center of

evolving challenges in regard to water security, food supply, socioeconomic prosperity, as well as climatic dynamics. Wu, Darton and Borthwick, (2016), observed that the management of river basin therefore needs to appreciate and incorporate the broad objectives to meet the needs and cope with uncertainties. Five perspectives were identified to describe the sustainability of river system: sufficiency of resource, elasticity to water-related risks, availability of water supply and other services, productive application of water, and justice between different users over temporal and spatial aspects. Such perspectives could be used to identify impacts on sustainability and to address impact generators, setting benchmarks and identify appropriate goals to improve sustainability. Gleick, (2009), used the term, basic water requirements, to describe water used for the four basic needs of human beings: water for drinking, for human hygiene purposes; for sanitation services; and water for domestic use such as food preparation. Gleick proposed that 50 litres of water is the minimum required per person per day, to meet these basic needs, no matter the individual's economic, social, or political status.

2.3 Water Resource Management Tools and Sustainability of Projects

In this section a review of literature on water resource management tools and sustenance of projects in a river basin is done. The tools referred to include the enabling environment, institutional structures, management instruments and infrastructure development. An investigation was led in Mbagathi subcatchment situated in Nairobi metropolitan, Kenya, by Nyika, Karuku and Onwonga, (2017), on the Water Balance for Mbagathi Sub-Catchment. Both essential and auxiliary information were utilized to assess the water balance for Mbagathi sub-catchment. Information assortment was ordered into gracefully and request whereby the previous, was sub-isolated into ground-and surface-water supplies. Groundwater flexibly was determined utilizing the dirt water balance technique. Surface water supplies from Mbagathi waterway were evaluated from normal release rates recorded in stream-stream check stations: - 3AA04, 3AA06 and 3BA29, from 2010-2015. Water Resources Management Authority (WRMA) gave the auxiliary information to the three stations that were illustrative of the sub-catchment's fundamental stream and their normal gave its release every year. Information got on water supplies, request and capacity change was exposed to ANOVA and mean isolated utilizing LSD to think about the methods for medications and their associations. The measurable noteworthiness alluded to $\alpha = 0.05$ except if in any case expressed. Rates were utilized to think about ground-and surface-water supplies. (Nyika, Karuku

and Onwonga, 2017), noted that the water preservation approaches utilized were dribble water system, reusing, water gathering and low-stream plumbing installations. The most drilled water protection strategy in the sub-catchment was reusing at 15% with Lang'ata and Kikuyu regions having the most noteworthy appropriation levels at 38% and 32.4%, separately. Reusing water to support kitchen gardens and for household errands was the most mainstream preservation strategy since it was modest and viable. The following inclination was water collecting at 11.35%.

Enabling environment, Institutional structures, Management instruments and Infrastructure development establish the water asset management devices, (African Ministers Council's on Water, 2012). Then again, waterway bowls are mind boggling socio-natural frameworks that reflect cooperation among people and their condition, along with all the numerous interests and exercises. It was further proposed that reasonable waterway bowl the executives calls for a coordinated methodology requiring a harmony between social value, monetary effectiveness and ecological manageability. Swallow, Okono, and Place, (2003), noticed that encounters over the world have indicated that enhancing these biological system administrations is a major test because of the need to accommodate exchange offs that are frequently inalienable at their interfaces. Across Sub-Saharan Africa, it is frequently testing to acknowledge financial turn of events and ecological manageability at the same time because of the degree of destitution, joblessness and imbalance and unforeseen weakness, (Guo, Ruan and Zhao, 2014).

African Ministers' Council on Water, African Ministers Council's on Water, (2012), did an examination on the advancement in incorporated ways to deal with the turn of events, the executives, and utilization of water assets in Africa. It was a piece of a worldwide study started in line with the UN Commission on Sustainable Development and executed by UN-Water, which had two parts; a poll based overview, that framed level 1, and a meeting based review at level 2. The poll and meeting rules were created by an UN-Water Working Group and endorsed by UN-Water. Level 1 was a different decision poll overview yet expanded to cover extra issues in its finished rendition. The Level 2 review was an augmentation of Level 1 to give a more inside and out comprehension of nation circumstances as questions and issues to be examined in organized meeting. It further qualified the discoveries from Level 1 through meetings, requesting suppositions and encounters from government and non-government partners; basically this was

blended methodological methodology. The information was engagingly introduced in type of rates, (African Ministers Council's on Water, 2012).

The general impression is that there is acceptable advancement yet a lot of work stays to be done to fortify the empowering condition for water assets management. Approaches, laws, and plans are set up in numerous nations yet are still in the prior phase of execution in most sub-districts with the exception of North Africa. The absence of these empowering instruments are raised as imperatives by numerous nations and the reasons why 25 % of nations have not yet begun to apply a water law and 50 percent is absence of the board instrument, specifically the administration plan. This was a review primarily on the empowering condition at the national level yet there are likewise supporting conditions that might be available at the sub-local, provincial, and worldwide levels, (African Ministers Council's on Water, 2012). Worldwide concessions to transboundary bowls are settled and execution is in progress in 77 percent of nations, and for the most part at a propelled stage in Africa. Since 75 % of nations are executing national water laws and 67 percent a water arrangement, unmistakably shows the dedication of African nations to practical administration and improvement of water assets. However, in most sub-districts, upwards of 50 % of nations, it is still at beginning times of usage or have not yet begun. In any case, understanding of these distinctions must consider normal variety in conditions, for example, relative significance of surface water against groundwater, normal precipitation, explicit conditions of island states, and national needs.

Nations announcing progress with the enabling environment additionally report progress with administration and institutional structures. There is a positive connection between these two variables and nations recording more significant levels of management with the enabling environment are probably going to have gained more prominent ground with administration and institutional frameworks. Enabling environment bolster and advance the foundation of compelling administration and institutional systems dependent on IWRM at transboundary level, national level, as national commissions or boards, at bowl level as bowl councils or organizations, and at neighborhood level as nearby water advisory groups, through institutional limit improvement and distributed sharing of understanding. Upgraded instruments for partner commitment, including food and horticulture, vitality age, industry, wellbeing, condition and partners at the degree of

stream bowl associations. Specific consideration given to making mindfulness about water assets the board and supporting consultative procedures for bowl arranging, (African Ministers Council's on Water, (2012). Upgrade limit working at all levels to get the essential HR for executing IWRM. Improvement of the empowering condition and administration frameworks for water assets will positively affect the board frameworks and at last on advancement. In spite of the fact that the information are not satisfactory to demonstrate a causal relationship, it is by consoling to see from the study a decent positive connection between advancement on administration and institutional structures and progress on water asset the executives instruments.

The overview examination uncovered a positive connection between the advancement on the empowering natural laws and arrangements and the advancement on foundation and financing, (Chitale, 2007). Progress with financing is similar to that for foundation advancement. The most significant perception is that the endeavors put resources into creating improved water assets the board could add to a superior venture atmosphere for water-related foundation. Further, undertakings to manage the utilization of water assets and control contamination are once in a while revealed as under usage in over half of nations. Indeed, even in the vast majority of those nations usage is at a beginning time. The overview shows that more work is expected to build up these administration ventures, to give water asset supervisors the full scope of the board instruments. Data the board frameworks are accounted for as set up in numerous nations. Anyway there is an absence of sufficient supporting apparatuses for information sharing which is a key instrument to help partner cooperation and limit building which, might be a restricting element to advance in these territories. Progress on the executives instruments is connected, and most likely ward upon, the improvement of administration and institutional courses of action. Water assets the board instruments give a commonsense premise to interpretation of approach into training. Choices are made on who gets water, what undertaking gets need, and therefore what are the social and improvement results conceivable. The Africa Water Vision 2025 and the (African Ministers Council's on Water, 2012), work program imagine the utilization of water for the financial advantage and advancement of Africa yet water for development and improvement is hard to accomplish without the use of these water assets the executives instruments. Explicit consideration ought to be given to advance and bolster the Water assets the executives instruments to give the pragmatic premise to interpretation of strategy into training.

In a study done by, Yericho, Berhanu and Meshesha, (2019), to evaluate the challenges and opportunities for usage of Integrated Water Resource Management in Omo-Gibe Basin, Ethiopia. Two regions at most, were chosen from each zone based on the accessibility of information and openness of the region for information assortment at that point, and small scale watersheds were haphazardly chosen in the locale. Additionally, 5% of test respondents were arbitrarily chosen for a meeting from each of the smaller scale watershed in addition to the 248 heads of family unit interviewed. What's more, an aggregate of eleven-centered gathering conversation was finished. Around 19 key witness' meetings were done along with information assortment from the accessible chronicles in the nearby, territorial and national workplaces were gathered and evaluated.

No more than two locations were sampled from each region. Both official and non-official conversation with the leaders of the zones, locations, farmers' association, institutional and villages were conducted. In addition, field observation, questionnaire survey, focused group discussion and key informants interview were used to collect data. Questionnaire survey with both open and closed ended structured questions was used to collect primary data from sampled households. Key Informant Interview was carried out with champions and professionals who had in-depth acquaintance and knowledge of their environment, and who further played profound role in the local institutional leadership as they were highly recognized in the community. Data analysis was done with SPSS version 20 and descriptive statistics, t-test and chi-square test were used as well. Population estimates were done by geometric method of growth, with 3% growth rate. The findings indicated that lack of basin organization and poor capacity building, coupled with a clash between the water resource boundary and the political boundary was a challenge. It revealed that different regions and different locations in the same zones lack harmony in water resource management, (Yericho, Berhanu and Meshesha, 2019).

There were no formally accepted institutions to bring harmony and unite the different interests since none was responsible for the integration of water management within the basin, other than the Ministry of Water at federal level. . However, lack of central planning, Omo-Gibe basin, was one greatly limiting factor for successful implementation of integrated water resource management aggravated by lack of skilled manpower. Population growth, as noted in every locality, further led

to over exploitation of forest resources, (Fulazzaky, 2014). Financial constraints, as well, hindered the adaption of modern technologies in water resource management. It was noted that the challenge was not so much the budgetary constraints but the poor allocation and complex procedure of budgeting from central to local government. In addition, corruption of public budget presented another major setback to the catchment, specifically and to the country in general.

2.4. Enabling Environment and Sustainability of Projects

The Enabling Environment includes the strategies, administrative system, financing and motivating force structures in Water Management. An increasingly exact meaning of the enabling environment can be the arrangement, institutional and monetary structure that is vital for supporting and duplicating enormous scope programs, (WSP, 2015, December 2). Water strategy change, in Kenya, attempted in 2002 and consolidated in the 2002 Water Act, (GoK, 2002), essentially reshaped the institutional game plans, (Baldwin, 2015), and converted into a perceived lawful model for stream bowl administration. Two variables drove this change: the trouble and cost of working and checking the concentrated expectation and control system and the downstream and upstream water client's clashes, (Aarts, 2012). In spite of the fact that the stream bowl administration framework, in Kenya, was created in a participatory way with the incorporation of water specialists, nongovernmental associations, and network agents, the basic issues with the demonstration, a few creators contend, is the avoidance of country destitute individuals, pastoralists, and other underestimated on-screen characters from its advantages, (Robinson, 2010). In a study done by Chumbulla and Ally, (2018), on the role of local institutions in the creation of enabling environment for water project sustainability in Iringa District, Tanzania depended on a cross - sectional research configuration to permit information to be gathered at a solitary point in time. The structure took into consideration the engaging examination, translation, just as assurance of connections between factors. Three towns were arbitrarily chosen inside Iringa Rural District. The standard for town choice was accessibility of a water venture. Sixty (60) family units which were profiting by the task were arbitrarily chosen to make an aggregate of one hundred and eighty (180) families. Nine key sources, six from the town level and three from the locale level were to gather subjective information to enhance the data which was gathered through perception and organized poll studies. Double strategic relapse model was utilized to decide the variables for the maintainability of the undertakings. The outcomes uncovered that about 93% of the respondents

knew about the town by-laws and guidelines for ecological assurance. Just 6.7% of the respondents didn't know about these by-laws and guidelines. This suggests the town and water board of trustees pioneers in the task regions assume their jobs of teaching individuals as needs be on ensuring their condition particularly water source regions.

Chumbulla and Ally, (2018), opined that, data from semi-structured interviews were broken down into the smaller units that enabled the researcher to assess the values and attitudes of the respondents. Mapping the institutional arrangements for water project management that showed the roles, types, responsibilities and management activities of the institutions to ensure the sustainability of water ventures in the villages was done. In addition, the use of binary logistic regression model to determine the factors for the sustainability of the projects was applied in an effort to explain the factors most probable to determining the outcome variable, sustainability, based on a set of values. The sustainability was dichotomous variable taking two values: 1, when the projects were viewed as sustainable, and 0, when otherwise viewed.

Variable execution of the by-laws relies generally upon clients' information about the laws and the related punishments. The discoveries demonstrated that most of network individuals know and learned about the substance of by-laws for natural insurance. At the point when the respondents were approached to clarify what the standing rules specify, 74.4 % of the respondents figured out how to refer to cultivating limitations around water sources as one of the things in the by-laws. About 6% of the respondents referenced keeping creatures around water sources as a movement, which isn't permitted by the by-laws. About 13% of the respondents had the option to specify two limitations specifically: cultivating and keeping creatures around water sources as unsatisfactory exercises in the town by-laws. Just 6.1% of the respondents couldn't make reference to what was contained in the town by-laws for natural insurance. Regardless of their reality, a couple of residents showed that they didn't know about what is expressed in by-laws and guidelines. Chumbulla and Ally, (2018), noted that it very well may be inferred that the mindfulness level is high given the discoveries from different center gathering conversations. When the center gathering disscussions, at Mgera Village were approached to clarify what may be the reason for unreasonableness of water asset extends in the region coming up next was the reaction. 'individuals are simply difficult, no one in our town can say that he/she isn't educated about the presence of by-

laws administering water asset use… . the main test is that we can't refer to the particular guidelines… … we generally be cognizant once we do anything around water sources.'

The study used three projects, namely; Kitapilimwa water project, Mgera water project and Tanangozi-Kalenga water project, selected on the basis of water availability. Sixty households that enjoyed the servises from the project were randomly selected to sum up to 180 households in accordance to, (Matata, 2001). Six key informants from the village category and three from the district category, purposively selected to offer detailed information, based on their involvement in water availability that included; sources of water, supply constraints, distance and time, in addition to the respondents' participation in the water venture development, gender considerations on water management, and resource placement for project infrastructural maintenance.

Key informant interviews and focused group discussions, FGDs, offered qualitative data with a check list of items to guide the interrogations and deliberations, whereas the quantitative data were gathered via interview with a structured questionnaire having both open and closed-ended questions to obtain different information that included the role of various institutions, social aspects, economic aspects and environmental aspects that affected the sustainability of water projects. From FGDs and field observations, data was analyzed using content analysis.
Data from semi-structured interviews were broken down into the smaller units that enabled the researcher to assess the values and attitudes of the respondents. Mapping the institutional arrangements for water project management that showed the roles, types, responsibilities and management activities of the institutions to ensure the sustainability of water ventures in the villages was further done by, (Matata, 2001). In addition, the use of binary logistic regression model to determine the factors for the sustainability of the projects was applied in an effort to explain the factors most probable to determining the outcome variable, sustainability, based on a set of values. The sustainability was dichotomous variable taking two values: 1, when the projects were viewed as sustainable, and 0, when otherwise viewed.

Further, the investigation done by (Philippe, 2014), on an Evaluation of Integrated Water Resources Management (IWRM) exercises utilized online poll study that tended to National and International Water Expertise to get suitable data for the examination. The National Water Policy

in Bangladesh is charged with the maintenance, re-evaluation and dispersing the National Water Resources Database. To satisfy the need for data and information for the planners and researchers, among others related to water and connected sectors, the data was collected from a variety of sources and categorized into relational database sets. The functional stations for rainfall, evaporation, surface run-off, sediment load and water quality in Bangladesh are up to the standards of the World Meteorological Organization. In excess of 406 data layers are available, that have been classified into three level stairs which comprised of; the data group, type and layer. Most of the data layers refer to the spatial data, time sequence and attribute data. The data groups refer to the base data, the resources on board include; Surface Water, Groundwater, Meteorological factors, Soil and Agricultural aspects, Forest and Fishery.

Discoveries demonstrate that the National Water Policy, (NWP) has not been audited during the most recent a long time since it neglected to conceptualize the term IWRM unequivocally. In Bangladesh, the significant arrangement in water segment advocates for social value, preservation of normal ecological and productivity of water the executives which are the fundamental parts of IWRM. Achievement factors are grounded in the structure, arrangement and connections inside the approach organize. The selection and usage of a coordinated way to deal with bowl arranging, at both the transboundary and sub-national levels, is one key methodology as an empowering domain, (African Ministers Council's on Water, 2012). The examination demonstrated that, the advancement towards Integrated Water Resources Management (IWRM) in Bangladesh has been acceptable albeit much stays to be finished. In any case, progressing IWRM is a procedure of steady advances and the Bangladesh water related segment is unmistakably moving the correct way towards the IWRM plan. Then again, Newig, (2010), included that the elements deciding arrangement impact identify with methodology for strategy advancement and definition, substance of the approach itself, the reverberation of new arrangement with existing gauges of conduct and the expenses of consistence and checking.

For a situation study done to assess the usage of coordinated water asset management in the Inkomati River Basin, in South Africa, Swaziland, by, Melanie, Thandi and Rashid, (2015), information from both essential and auxiliary sources were gathered through a survey that focused partners with a foundation and information on the procedure of water management in the Inkomati

River Basin. The examining system utilized to choose review members was purposive non-arbitrary, with respondents deliberately chose to address the target which decides the viability of usage of the IWRM change regions in explicit organizations. Overview information were caught and coded into an Excel database and afterward brought into the SPSS, programming for investigation. Respondents in the Inkomati River Basin contextual analysis were solicited whether they knew from water approaches in the bowl identified with distribution, checking, contamination, flood and dry season control. Results demonstrated that a high number of respondents knew about water approaches set up in the Integrated River Basin. The most elevated among these was consciousness of water assignment strategies, demonstrated by (76%), while attention to water observing approaches was shown by (71%). Respondents in South Africa, who exhibited a high attention to water observing approaches in the bowl, showed that the Inkomati Catchment Management Agency (CMA) is right now taking an interest in water checking programs for the catchment. Further, Melanie, Thandi and Rashid, (2015), found that not exactly half (45%) of the respondents showed consciousness of a flood and dry season control strategy being set up in the bowl. Then again, a greater amount of the Swaziland respondents, (67%), showed attention to a flood and dry season control arrangement. At the point when further inquired as to whether the flow strategies contain the water asset the executives standards, respondents in South African and Swaziland showed that the flow arrangements do contain these standards.

In a study to explore water shade sustenance and water management along Pangani river basin, Tanzania by, Makarius and Patrick, (2015), four villages were covered in Arusha region within Pangani River Basin, PRB. For data collection, purposive sampling procedure in addition to questionnaire survey was used. The proximity to rivers and reliance of the communities on water for irrigation, guided the choice of location targeting smallholder irrigators. Table of random numbers was used to determine the representative households in line with the house registration numbers. Household heads were interviewed; otherwise, a randomly chosen member above 18 years old in the absence of the household head was taken as a substitute. In Tanzanian laws, a person above 18 is considered an adult. The study used both the qualitative and quantitative data collected from both secondary and primary sources. A structured questionnaire was the lead instrument for the primary data collection. On the other hand, qualitative data was gathered through indoor open consultation with individuals and committee members on water basin

sustenance and water governance. Discussion with officials of Water Users Association, WUA within the PRB was also done in addition to interviewing the regional and district levels water officers. The key issues in focus were administrative aspects, information availability, policy application and instruments, sustenance objectives and level of accountability by the staff. The policy tools applied included technical, economic, administrative, legal, institutional and social or participatory. The results on the water projects sustenance in PRB suggested two approaches, (Makarius and Patrick, 2015). One is retaining riparian in-situ conservation and second involves application of human solutions such as tree planting, construction of concrete canal, clearing water canals as well as the springs.

In this study, Water Users Association was used to refer to a consolidated group of smallholder farmers sharing common interest of improving the supply of irrigation water. The results of the discussion groups showed that Mbukita WUA collapsed due to failure of leaders to convene regular meetings as dictated by the by-laws. Further, failure to declare revenue and financial expenditure on regular basis, as well as delays in submitting water use fees to Pangani Basin Water Organization, PBWO headquarters in Moshi, compounded the problem, (Tagseth, 2009). Again, Mbukita WUA leaders tended to prioritize politicians and top civil servants during the water rationing, a form of corruption. These failures led to split of the WUA, resulting in the formation of new sub-canal leadership. Other challenges were abuse of leadership position, lack of accountability among the staff and leadership, political interferences, theft of the collected funds, ineffective enforcement of the by-laws and inability to bring together all the stakeholders within the PRB. However, the study found that WUA is essential for the facilitation of the water resource governance at local level, facilitate water management decisions pertaining water allocation and rationing and to collect water fee from smallholder farmers.

Purposive sampling and questionnaire survey for the four villages sampled based on the proximity to the rivers and dependence of the local community on the river services. Targeted were the smallholder irrigators done by use of random numbers that correspond to the household number. The head of the family or in absence, any member, above 18 years, chosen at random were interviewed. Both quantitative and qualitative data were gathered from both primary and secondary sources. The main tool for data collection was structured questionnaire. Open consultations with

committee members and individuals were done in addition to a series of in-door inquiries. Key informants were the district water officer and ward or division irrigation officers. Focused Group Discussions, FDGs, were conducted at the local levels with ward and division extension officers, Chairpersons and secretaries of WUA.

Data analysis was done using SPSS, and multiple response method to obtain frequency and percentages of the responses from the small holders. For qualitative data, multiple level governance framework tool was used to analyze the water governance difficulties, gaps, openness and accountability, (Akhmouch, 2012), in addition, content analysis that involved dialogue and extensively heated debate in a way that allowed the extraction, examination and digestion of content to themes and patterns done in a participatory manner that enabled the understanding of reality in a subjective but scientific manner.

The WUA management inefficiency resulted in a poor crop harvested, water use conflict, hunger and reduction of income for the members. The study found that the reduction of water was mainly driven by; lack of competency among the water officials, ineffective WUA, climate change and variability, water abstraction by foreign investors, population increase and degradation of water basin. Further, the locals at times lacked clear understanding of WUA functions and some were not even aware of the components and content of water user permit document, (Tagseth, 2009). WUA members in the upstream and those downstream paid more than those in the middle section, the rationale for this variation being that the upper members got plenty of water relative to the other regions while the downstream paid more due to their greater need for more infrastructures. Likewise, weaknesses in information dissemination, policy constrains, low capacity of the technical staff further, undermined the water basin management and water governance in PRB, worsened by contradicting objectives of the WUA and lack of adequate funds, greatly contributed to the collapse of Mbukita WUA in PRB.

In conclusion, enhancing smallholder farmers to establish and maintain the existing WUA is pivotal for basin sustainability and for water flows. The presence of WUA in the study area is a testimony of the implementation of the Dublin principles, (Tagseth, 2009). Study findings, also, indicate that presence of water committee lessens water use conflict and enhances sustainable

water and management. This illustrated to the policy makers, the urgent need for devolution, to let power go to the lowest level, (Ostrom, 1990).

2.5. Institutional Structures and Sustainability of Projects.

Literature review is done to cover institutional structures that include training among the participants, stakeholder involvement and hierarchy of institutional organization. In an investigation done in Arusha and Kilimanjaro of Tanzania by, Makarius and Patrick, (2015), on Exploring watershed preservation and water administration along Pangani River Basin, quantitative and subjective research approaches were utilized. Organized polls was the fundamental device to gather quantitative information while inside and open interviews with people and board of trustees individuals utilized for qualitative information. Quantitative information was investigated descriptively and qualitative information broke down by content examination approach including extreme discussion inside the center gathering. Discoveries demonstrated that, Water User Association, (WUA), crumbled because of disappointment of the pioneers to assemble ordinary gatherings, and further that the drivers for water decrease are ineffectual WUA, (41%), environmental change and fluctuation (23%), water reflection by outsiders (18%), populace increment (13%) and corruption of water conceal further add to water decrease.

Institutional jobs include making hierarchical structure in different structures and capacities, waterway bowl and building institutional limit by creating Human Resource, IWRM, (2010). An administration board of trustees equitably chose settles on choices at the neighborhood level, and the seats of these panels establish the WRUA the executives' council, while the WRUA gets directions from WRMA and the Ministry of Water and Irrigation, (Jampel, *et al*, 2016). The connection between the distinctive choice levels is through criticism and shared impact, as opposed to carefully various leveled. Existing worldwide organizations tending to water assets are extremely feeble as far as guideline, yet moderately great at plan setting, sharing data, activating individuals, and, to a huge degree, in assembling assets, (Schubert, 2013). A gradually improved organization alone in all probability will be, best case scenario, ready to embrace emergency the board, however will be unable to take dynamic and preemptive strategy measures to counter the issues confronted, (Dellapenna, 2013)).

Minhaz, Mazlin and Lubna, (2020) investigated the factors that determined the people's readiness to engage in the sustainability of water resource management in Langat River Basin, Malaysia Questionnaires and informal interviews were used to gather data from the respondents. A sample of 450 was taken from the 1,028,003 households in the Langat River Basin, to give the appropriate number for the survey to run the statistical, structural equation model for measuring people's readiness to engage in water management resource management. In this endeavor, structural equation modelling (SEM, was used to determine and map out the hypothesis together with the perceived research model, which was widely accepted as an approach used in esitmating human character and customer mental perception, (Robina & Fontaneda, 2018). SEM approach is greatly valued for its ability to explain the measurement error, (Hair, 2017). The findings showed that people are highly educated in the Langat River Basin, and in the model relating to readiness to engage in water resource management, the education component of the respondents indicated a significant and direct influence on their readiness to engage in water resource management. Heterotrait-monotrait ratio (HTMT) was used to determine the discriminant validity level whose defined ratio had to be less than 0.9, (Hair, 2017).

In this study, people's readiness to engage in water resources management would be enhanced if it was positively mediated by people's mind-set towards and cognizance of a water resources management programme, along with the mind-set towards and cognizance of river and drinking water, believed health risk, the beliefs in institutions and policymakers and understanding of the river and drinkable water. Likewise, people's mind-set in water management would also be improved if people's perceptions on water quality (PWQ), together with the values of the river and drinkable water as well as their place of residence, positively enhanced their engagement in water management. The study found out that environmental education would change people's mind-set to raise the awareness of water resources and their engagement in water resource management. The study concluded that there is need for an effective multi- stakeholder forum for water resource management that would be compatible with a meaningful engagement in management program together with the government, non-government organizations, and academia and business community. Therefore, the local institutions can take proactive leading roles since they have the capacity to enforce through the Local Government Act of 1976 to change the perceptions of people on the value of water management through practices such as special training and campaigns. Thus,

Minhaz, Mazlin and Lubna, (2020), noted that campaigns and public forum are appropriate tools for active engagement by the people in natural resources sustainability, and their positive mind-set can contribute immensely to sustainable water resources management.

In light of the interviews done by Isabella, George, and Onyango, (2019), during a study on Understanding Institutional structures and their role on climate change adaptation: An instance of Mara River Basin, Kenya. The study focused on four thematic areas of processes that involved development, enabling production, and energizing processes. As a result, four quadrants were developed from these thematic areas and treated as a set of potential objects, the relationships between them and between these objects as sets and their environments. The Researcher then designed questions in line with these quadrants so as to measure structures to determine those enabling and those that hinder the institutions from functioning effectively, with which the Institutions were interviewed and responses to the set of questions enabled to gauge their state. The methodology comprised of six steps as a process of generating data. First step involved asking each question and the score noted next to the question, on a likert scale of 1 to 5. Second step was to transfer the score to the analysis table versus the question number, while the third step, the totals for each set of scores were calculated and a mean determined. Then, each set of means were changed to a percentage, and the means were set as 5=100%, 4=80%,3=60%, 2=40% and 1=20%. The fifth step, the final quantitative analysis used to make conclusions. For the scores above 50%, were taken to imply that the structures are reinforcing adaptation practices, less than 50% were meant that the structures are hindering adaptation practices.

It established that the government institutions most enabling structures fall in the enabling processes quadrant at 97%, here the government institutions are indicated as having strong coordination ability and are stable (98%) and they have rules and procedures that guide their activities and are measureable (95%). Conversely, the government's weakest structures are found in the developing processes quadrant at 48% within which participation in decisions, skills and knowledge stands at 40% while positive interpersonal relations and effective communication stands at 55%. In addition, the study found that in the Mara River Basin the majority of the institutions are tackling issues related to food security, access to clean water, environment and energy which are heavily dependent on the climate. Ultimately, Isabella, George, and Onyango,

(2019), agreed that the local institutions have not been able to fully embrace the United Nations Framework Convention on Climate Change, UNFCCC protocol on climate change adaptation or Kenya's National Climate Change Response Strategy has not put mechanisms in place to include climate change in their mandate.

A study was done by, Khin, (2019), on Building Institutional Capacity for Water Governance: A Case Study on Integrated River Basin Management in Myanmar, A series of open interviews with water professionals, that included a Water Resources Officer at the Dutch Embassy in Yangon and a water resources engineer from a local consultancy and engineering firm in Yangon were conducted, besides a symposium. Further, data on line was retrieved from www.airbm.org and from the AIRBM project, and to incorporate the cultural aspects of institutions, two community consultations were held. Context report and document analysis was achieved by way of constant comparative method in which each element in the research data, documents and observation notes is compared to all other elements in an iterative process, (Thomas, 2015).

The institutional transition of the water sector in Myanmar towards an IWRM regime was assessed. Findings showed that the status quo of this transition could be described as a sectoral regime with high levels of centralization (low vertical integration) and fragmentation of governance (low horizontal integration). Different functionalities of water resources have been institutionalized under separate governmental agencies with often competing mandates. The history of sectoral government structures has led to beliefs that responsibilities should be formally assigned to qualified officers in order to drive change.

To Investigate the Institutional Landscape for Urban Water Security in Nepal, led in Dharan and Dhulikhel, which spoke to tests of the intricate and different scope of water organizations at the network and the city level arranged at the lower regions of the Mahabharata Range, Pandey, Maskey, Kamal and Ojha, (2019). The examination was required by the joined difficulties of fast and impromptu urbanization, populace development, and environmental change that fuel the effects on water assets and water the executives. A blended way to deal with essential information assortment and examination was supplemented by an intensive writing audit of the job of organizations for water the executives. Throughout three years of field study, 28 people were talked with, 14 from every city. These included chosen officials and civil servants from the district,

officials from Nepal Water Supply Corporation, Dharan and Dhulikhel Drinking Water User Committees, and water clients from upstream and downstream networks, water board individuals, ladies, and minimized individuals from target areas, for example, vagrant settlements in Dharan. Three center gathering conversations were likewise directed in every city; bunches included different and separated urban water clients and administrators, among others. An investigation of meetings with the partners of Dharan uncovered that there are different foundations occupied with the water the board of the town, notwithstanding, they don't facilitate and connect with one another. Or maybe they hold complaints against each other through smaller scale legislative issues, making a non-genial relationship. Foundations rehearses conflict with all the current strategies including the casual establishments of different little water-client gatherings, ladies' systems, self-administration, for example, individual and institutional clients, filtered water, water big haulers, and nongovernmental associations in the two urban communities, (Pandey, *et al.,* 2019)

In a astudy that targeted the community water Governance on Mount Kenya, the Likii Water Resource Users Association by, Jampel, Paul, Drew, Stefan, Kelly, Caylor and Tom P., (2016), focused on the community water partnership that were WRUA members of Likii in the Upper Ewaso Ng'iro River basin in Kenya. Semi structured interviews, in which active engagement of local stakeholders was imperative, and members of every community water partnership management committee were also interviewed. The study found that the management system in the upper Ewaso Ng'iro River basin of Mount Kenya can be described as a model of positive institutional transformation that involves the local stakeholders, encourage active engagement, capacity building, cascading centralized powers to the lower level actors, and equity in water allocation.

Success in the institutional system ought to be established on an active process of social learning that involves reflective participation and engagement of actors at various scales. Institutional design many a times may prevent the systems from adapting and coming up with solutions, (Pahl-Wostl, 2013). Such situations could be described as undergoing institutional lock-in. Collective learning provides an acceptable option for improving control steps and raising adaptive ability. In systems with many players, such as river basin management, the probability is high, that conflicts, instead of collective learning will greatly influence institutional building, and conflict can

compromise the opportunity for collective action. From the in-depth interviews with Community water partnership, and the leadership of WRUA, together with a review of the by-laws and other available documents, it was revealed that bottom-up representation is a critical feature of the Likii sub-catchment basin management, (Jampel, *et a*, 2016). It involves a process by which the chair of every Community water partnership management committee would represent the Community water partnership in the WRUA management committee, forming the higher legislative body. This provides a procedure by which the people affected by the legislation can engage in establishing or adjusting them. The study concluded that reflexive management is challenging, and the rate and magnitude of change calls for a deep and constant participation of the stakeholders and realignment of institutional approaches. Going forward, water management in Mount Kenya will mostly relay on the way and extent of collaboration including sharing of information and on how adaptive to socio-environmental change the institutions are.

2.6. Management Instruments and Sustainability of Projects in River Sub-Catchment Basin

Literature review is done on economic instruments which involved the use of prices, subsidies, together with other market-based measures to provide incentives to all water users to use water carefully, efficiently and control pollution. Economic instruments, are intends to accomplish improved financial effectiveness, social value or ecological insurance. The study targeted water pricing mechanism, rate of water payment and the level of financial incentives. In an examination done in Mbagathi Sub-Catchment in Kitui on Water Resources Inventory and Assessment for Sustainable Development, (Nyika, Karuku and Onwonga, 2017), indicated that disbursement and pay off cases have hindered water installment by clients without change.

A two-step survey approach involving mapping the formal network structure of water users in Mbagathi sub-catchment by listing all users in WRMA's database then asking them to identify others not listed to give additional water users was employed. Household heads and industry operations managers were interviewed individually using a pre-structured questionnaire on the sources and amounts of water used daily in litres, which were then converted to m^3. The results were compared with secondary data of 2010-2014 from WRMA databases. Ground- and surface-water storage changes in the sub-catchment were obtained by deducting total demands from supplies and reported as positive or negative balance. Data obtained on water supplies, demand

and storage change was subjected to ANOVA and mean separated using LSD to compare the means of treatments and their interactions. The statistical significance referred to $\alpha = 0.05$ unless otherwise stated. Percentages were used to compare ground- and surface-water supplies.

The discoveries, further, uncovered that metered water clients were higher (mean=53.5, 30%) contrasted with paying clients (mean=19.75, 11%) over the examination territory and the two gatherings were factually huge ($p \leq 0.05$). Also, 11% of all water clients were paying for water while just 30% had introduced meters. Lang'ata had 45.6% paying clients, the most elevated, contrasted with 0%, 22.8%, and 31.6%, Ngong, Kikuyu Kathiani, territories, individually. In like manner, Lang'ata had the most elevated metered clients of the watched 30% at 44.1% then Kathiani, Kikuyu and Ngong subcounties at 31.6%, 14.9% and 9.4%, separately. Carelessness by the water Service Company to do metering and conceivable debasement and pay off to requirement officials by rebellious clients could clarify the watched consistence pattern.

Further, Neil and Ross, (2018), underscores that Economic Instruments, are intends to accomplishing improved financial effectiveness, social value or ecological insurance. What's more, Atef, (2014), alerts that Economic Instruments ought to be embraced dependent on their capacity to add to explicit water strategy goals, including targets identified with financial productivity, social value and ecological safeguarding. The executives instruments help oversee interest for water and upgrade financial action in accordance with ecological insurance as strategy destinations. Further, (Neil and Ross, 2018), pointed that the fundamental capacity is to support monetary specialists, change their conduct, to add to sound water assets the board, preservation and insurance just as apparatuses to create income to back water the executives or give water-related administrations.

With conventional methodologies of order and control in overseeing water having demonstrated deficient to address these difficulties, new methodologies by approach producers and water administrators need to concentrate on motivating force put together instruments to decrease pressure with respect to water assets. For any green development procedure, the test is settling on singular choices rational with the cultural goals to cultivate development, annihilate destitution and improve social equity while, simultaneously, securing the biological systems that give the

water. Rockefeller Foundation, (2015), included that this requires the utilization of motivating forces to advance the ideal sorts of conduct through market based components and valuing instruments. In any case, Atef, (2014), pointed that setting up productive estimating frameworks is both a politically delicate issue and a specialized test, and thusly, water is by and large offered at low or zero expense in many creating nations. In any case, all administration instruments have focal points and impediments relying upon the specific issue nearby, and the financial, social and institutional system it works. While Atef, (2014), opines that the perfect administration procedures are those that can adequately create conduct change towards progressively productive water use, sufficiently rigid to support advancement, good with lawful and institutional system, sufficiently stable to offer security to speculators, politically worthy and implementable at a low observing and implementation cost.

A study focused on markets user rights by way of possible uses of economic instruments, such as water tariffs, to operationalize water policy in Brazil, (Gustavo, Guarany, Sol and Guilherme, 2018). The study was based on water resources experts' perspectives and beliefs which were gathered by way of surveys referred to as Delphi method, and on a focus group, to conceptualize if such instruments are useful and their possible contributions in the water basins of Brazil. Using a snowball process, respondents proposed other individuals they believed could also participate in this survey. Invitations were delivered electronically, at least twice. The groups of participants were a combination of people from governmental departments, academicians, water basin leadership, non-governmental organizations, and multifaceted cooperation among others. This combination of strategies ensured that all possible options were taken to account, and to assess and determine the extent of; public acceptance, technical practicability and suitability of all the proposed options. The focus group served to critique, align and polish the outcome from the two sessions of the questionnaires. This method consisted of several rounds of inquiry in which the respondents revealed their perceptions and ideas anonymously. After each cycle, responses are condensed and shared backward to the respondents in a new round of inquiry. When used jointly with the Delphi method, a focus group validates the data from the earlier inquiries, align and give logic to the results gathered from the many cycles of questionnaires, (Kidd and Parshall, 2000).

Findings showed that there is possibility and functionality for markets for the water use rights, albeit on a seasonal basis, domesticated, hugely associated with scarcity occurrences and jointly

with the other instruments set out in the Brazilian National Water Policy. Ultimately, many of the participants concurred that the use of water permits should be accepted as a document to be transferred in the market, though some caution was made, that water permits are yet to be legally safe and adequately incorporated in Brazil. It was found prudent to illustrate to users the variance between, a user right, as offered by water permits, and water ownership, and further that amendments to the law would be essential.

It was found that this effort would be more yielding if it appreciates two basic limitations to any valid study based on economic theory. That, economic propositions are basically conditional and contextual, (Rodrik, 2013)**;** thus, responses to a given problem rely, to some extent, on the situation that exist and are not always applicable to other situations. Second, it is critical to measure any proposed or existing policies and instruments against the institutions and their observed outcomes, and not against the perceived ideal notions in situations of imaginary and excellent implementation. In conclusion, the study suggested that the markets for water use rights in Brazil, have a role to played although, solely under some specific conditions such as periods of extensive scarcity for water.

Mazlin, (2009), did an examination on An Appropriate Institutional Framework Towards Integrated Water Resources Management in Pahang River Basin, Malaysia. To accumulate increasingly useful contributions for this investigation the conventional meeting meetings were directed with 20 officials from water related specialized government organizations, and 150 neighborhood people. The respondents basically were immediate recipients and adversaries, for example, government offices' officials, neighborhood ranchers, lodging administrators, palm oil domain administrators, water specialist organizations, and housewives. The meetings were arranged around the nearby water assets the board issues and evaluative measures inquiries for chose IWRM segments. Record was likewise explored by utilizing the evaluative measures of IWRM approach. Four difficulties were recognized: (a)Management of water assets productively and viably from the purpose of value and amount; (b) Moving towards coordinated stream bowl the executives; (c) Translating mindfulness into political will and limit and (d) Moving towards satisfactory, sheltered and reasonable water administrations. The investigation presumed that so as to improve the water gracefully and sewerage administrations and for better control, the Federal

Government needed to alter the Water Services Industry Act 2007, which moved water flexibly and sewerage administrations from the State rundown to the Federal rundown, (Mazlin, 2009). Despite the fact that there is a current extensive enactment structure in Malaysia, it is still absence of arrangement, for example, Water Resources Management Enactment in the State level to perceive the jobs of neighborhood networks into water assets arranging and the executives in Pahang State.

The study was done in Inkomati River Basin, (IRB) area, for possible comparative analysis since three states, each at a different stage of IWRM implementation, were jointly managing a common water resource in the basin, Melanie, Thandi and Rashid, (2015). Data was collected from both primary and secondary sources of data using a questionnaire targeting the stakeholders with experience and knowledge of water management in the IRB. The sampling methodology used to arrive at the survey participants was non-random, purposive approach, in which respondents were purposefully selected to address the objective that determined the success of implementation of the IWRM over the targeted change areas in the specified institutions.

Elements and methods that enabled and assist decision makers to make logical and fact based choices between the existing alternatives constitute the management instruments. Encounters, performance and execution in seven change areas of Management Instruments in the IRB were evaluated. This aimed at maximizing the efficiency in the use of existing water supplies as opposed to developing new sources, (GWP, 2006). It calls for a balance between the volumes of water available in the basin with the demand for the same. South Africa has initiated and executed national efforts for water sustenance and demand control. It was noted that there is lack of water use information in Swaziland, generally. Water for irrigation is controlled and monitored using permit issuance. Even with this control in place, the exact volume of water used is unknown and the relevant data difficult to come by. Respondents in this study of IWRM were asked whether the RBO monitors water use in the basin. The majority of respondents were positive that water use monitoring was being conducted by the RBOs.

The sampling methodology employed was descriptive survey design and the respondents purposefully selected to address the objective which determines the effectiveness of

implementation of the IWRM change areas in specific institutions, (Prinsloo, 2008). Survey data were captured and coded into an Excel database and imported into the SPSS software for analysis. Most of the respondents, (72%) of respondents indicated that there were forums to address disputes, 42% were of the opinion that such forums met only when need arises and 33% of them stated that such forums met quarterly. Analysis at the country level shows that the Most of respondents who opined that dispute forums exist, came from South Africa, while the majority from Swaziland respondents disagreed that dispute resolution forums do not exist. In South Africa the main issues included; water licenses, water resource issues to do with ground versus surface water, water pricing and re-allocation. Further, compensation and incentives, effluent system, pollution occurrences and formation of WUAs were among the challenges in the study area. Regulatory instruments are critical for the execution of water resource policies and legislative peremptory that creates operational guide, (GWP, 2006). Economic instruments involved the use of prices, subsidies, together with other market-based measures to provide incentives to all water users to use water carefully, efficiently and control pollution (GWP, 2012). Though the polluter-pays and user-pays principles have been approved, the manner of executing these remains a challenge. While the user-pays principle execution by basin organizations is still in the infancy stage, the tariff collection responsibility still rests within the central government. The study concluded that there are gaps in the instruments, particularly in relation to the evaluation of the integrated water asset management instruments. From the analysis, the pilot testing of the instruments in the IRB failed to provide insights into water resource evaluation, plans, demand control and regulatory tools in the basin. The analysis suggested a consideration of phased approach to evaluation of IWRM, since its execution seem to follow a systematic process that starts from creating the enabling environment, before the formation and execution of the institutional framework and ultimately the formation and use of integrated water asset control management instruments. The case of management instruments occurring in the tail end of this systematic process is expected since it forms the execution tools for integrated water assets control and given that the implementation of the integrated water assets control is relatively new in the IRB.

In a study done in U.S by, Wang, Mu and Jadwige, (2021), on the Perceived Economic Value Of Ecosystem Services In The US Rio Grande Basin, RGB. Online survey was designed with

Qualtrics software, university of Oklahoma. Questionnaires distributed to 350 stakeholders in the RGB, randomly selected fron US Geo-Spatial database together with the RGB residents and collaborators in the respective basin location. Three distinct groups were selected by the process of random sampling, that comprised of Employees of RGB, Residents of the basin & Tourists visiting the basin. To test the hypothesis, contigent valuation survey for key ecosystem services that turned out to be three; Fresh water supplies, Habitat for wild life and recreational activities that were selected based on representation of different service categories of privisioning, supportting, regulating and cultural services and the inclusion of water related services. Respondents were asked to choose from the four, the most important and to rank on a five point likert scale, this created an ordinal measure for each of the ecosystem services. Then, the respondents were asked if, willing to pay for these services through an annual donation to protect RGB to continue offering the services to society. Open ended contigent valuation was used to elicit responses on WTP for maintaining the ecosystem services. Responded reaction, if affirmative, then maximum WTP was marked but if the reaction was negative, then follow up questions on why they would not want to make monetory contribution, this was to differentiate protest response from real zero value. Based on the survey outcomes, the Heckman two step model was applied to WTP analysis, the benefit of this model is that it controls for the sample selection issue by simultaneous estimation of two processes: selection and outcome, (Chaikaew, 2017).

The linear probit model was used to determine the respondents decision (Z) on whether to support preservation, or otherwise, of ecosystem services. On the basis of the respondents general reaction on preservation of ecosytemservices, the stated amount of WTP in dollars, $ values was estimated using an OSL regression model. The least absolute Shrinkage and selection operator, (LASSO), was applied in the first place for the tow generated models to select the most relevant variables conditioned on asmall sample size. LASSO, regression analysis method performs both variable selection and regularization in order to enhance prediction accuracy and interpretivity of the statistical model, (Hynes and Chen, 2020). The results indicated a response rate from the various categories as; Employees of RGB, returned 30.0%, Residents of the basin, returned 67%, & Tourists visiting the basin, rate of 11.3%. The socio-economin characteristics of survey respondents compared well with 2010 U.S. census data. The medial household income ranged from USD 60,000 and 80,000 per annum while the average household size was 2.7 persons. A

reliability test was applied to confirm the reliability of the respondents attitude variable, in terms of Cronbach's alpha value, which ranged from 0.604 to 0.842, confirmation that the survey more reliable.

The WTP for ecosystem services services, provided by the basin was averaged at USD 62 as an annual donation. A wide variability in WTP was found for each type of Ecosystem S based on the respondent's perception. Habitat for wildlife gave the highest mean WTP, USD 26.2pa, while fresh water service followed with USD, 19.7, in annual donation. The findings showed that participants were willing to pay more for the river Ecosystem Services that they find most relevant for the RGB, and that was mostly affected by upstream water use and drought. However, they felt that the payment for habitat for wildlife was in support mainly for cultural, regulating or supporting Ecosystem Services, rather than provisioning Ecosystem Services, such as fresh water supply. Since water is a common good, human tend to anticipate a secured access to water without necessarilly paying for it, (Hynes and Chen, 2020).

Deterioration of ecological Ecosystem Services due to human activities and changing climate has seriously threatened food safety, human health and sustainable developmentt of river basins in US and many other countries. Ecosystem Services that contribute directly to human well-being are increasingly taken into consideration in decision making process, international treaties and conventions. Undertanding the benefits and the economic value that people get from ecosystem is good for making water management strategies and policy decisions. Fresh water supplies were shown to be most important but most decreased service in the last decade. It is suggested that people prioritize services that directy affect health and local economies, that include drinking water, farming and fishing. Among the four analyzed Ecosystem Services, cultural heritage and recreational activities were judged as the least important. Hence local managers and policy makers, to improve watershade services, should prioritize managing and allocating services between competing demands. The high variability of WTP for the respective Ecosystem Services reflects the heterogenous perspectives towards value provided by watershade . The relatively low WTP for cultural services show that the enjoyment of out door activities and appreciation of beautiful, natural sceneries are not as crucial as fresh water demands for human beings. In addition, people intuitively, with high income were more responsive to providing financial support for maintaining

Ecosystem Services, while the Basin residents were more WTP for preserving water services than non residents. However, Wang, Mu and Jadwige, (2021), found that the parents/grandparents' residents within the basin were found to negatively related to WTP decisions, as in other studies, this can be possibly explained by an implicit perception of residents that their parents and grand parents have already paid for the Ecosystem Services in the past and hence their personal obligation has been lightened

2.7 Infrastructure Development and Sustainability of Projects in River Sub-catchment Basin

The infrastructure considered in the literature review in this section involved; slope stabilization practices, water pans and ponds, waste treatment plants and dumping sites available. These are the physical and biological structures that aid in the sustainability of projects in the river basin. Utilizing Spatial Information Technologies as Monitoring Devices in International Watershed Conservation along the Senegal River Basin of West Africa and dependent on a blend scale strategy, an examination accomplished by, (Edmund, 2008). Clear measurements, tied down in geospatial data innovations of GIS and Remote detecting advancements dependent on the mix of essential information given through government sources and information based from different associations. The initial step included the distinguishing proof of the factors expected to evaluate ecological changes at territorial level inside a watershed. The factors comprise of financial, physical and ecological data, including the measure of farming cropland, human settlement, water bodies, timberland types, exposed territories and bushes.

Examination of the information on water use in the zone demonstrated that farming stands as the greatest client of water, among the different segments. The breakdown of water utilization by part demonstrates horticulture to be the significant client of water followed by household living arrangement and businesses. Among the individual nations, both Senegal and Mali seem to have utilized indistinguishable volumes of water assessed at 1360 million meters between 1987 while Mauritania devoured 1630m3 more than its neighbors. While the redirection of water towards farming among the nations remained in the request for 1319 million meters, for Mali, 1499 for Mauritania and 1251 for Senegal, their household utilization of water varied irregularly by 27, 101 and 68 million meters individually, (Edmund, 2008). Inside a similar time, mechanical utilization

of water in Senegal assessed at 41 million meters seems to have outperformed the 29 million meters devoured by Mauritania, and the 14 million meters utilized by Malians. In any case, a portion of the progressions achieved in the area through water system and the structure of hydroelectricity dams and different practices in the previous examination, water keeps on being in incredible interest among the nations in the Senegal River bowl. For the motivations behind directing an ecological change examination in global watershed the board, the water utilization examples of individual nations and the condition of the asset merit some consideration, going ahead.

An investigation to evaluate the difficulties and chances of actualizing incorporated water asset the board mediation in Omo-Gibe bowl, Ethiopia by, Yericho, Berhanu and Meshesha, (2019). The example small scale watersheds were arbitrarily chosen and respondents haphazardly chose for meet from each example smaller scale watershed. Thus, around 248 heads of family unit interviews were directed and test size was obliged because of money related imperative. Further, eleven-centered gathering conversation was done along with 19 key witness' meetings completed. Field perception was centered around perception of biophysical attributes of watershed like land corruption, crop designs, dissemination of settlements, singular exercises in the cultivating plots, ranchers' property the board rehearses, water assets, bramble and munching lands, and other pertinent parts of water asset the executives in the catchment. The examination found that the significant test was huge extent (65%) of steeply incline and land corruption, along with absence of water asset framework and advancement (81.9%). Then again, recreational utilization of water in the territory is likewise regular with a few locales well known for its cascade. Further, the dams were utilized as spot for angling, through which neighborhood network individuals partake in angling exercises for food and selling, (Yericho, Berhanu and Meshesha, 2019). Changes in the spatial circulation and structure of human exercises have prompted expanded urbanization and its related negative ecological effects, therefore, for the structural designer, a significant test is the improvement of viable devices to gauge and upgrade urban supportability, particularly through the plan and the board of framework. At the core of urban supportability issues, lie framework frameworks, (Halla, 2017). The advancement of quantitative structures for evaluating the drawn out manageability of framework identifying with, on one hand, dynamic, venture arranging, and resource the board, and on the other, ecological factors, for example, vitality use, materials inflows,

residuals, and at last, an effective help arrangement to keep up and improve personal satisfaction, is the fundamental goal.

A study on effects of liquid waste management approaches in High End Hotels, (HEH), on waste water quality in Sekenani, Masai Mara Game reserve, Kenya, was done by, Chiro, Thuo and Abila, (2020). The study adopted experimental, purposive and quantitative research design for the Hotels and Lodges within Sekanani in Mara River Basin. Purposive sampling was used to select the four HEH tourist facilities; AA Lodge, Simba Lodge, Saro Lodge and Sentrim Mara. ANOVA was done using SPSS version 20 at 95% confidence level and p- value <0.05 considered statistically significant.

The study assessed the effects of liquid waste management approaches by the four HEHs on water quality in Mara Game Reserve. It was noted that the various facilities use different aproaches to treat waste water, Septic tank used in AA Lodge, Aerated treatment plant was used in Simba Lodge, and Soak Away and two Lagoons in Sarova Lodge. It was found that the levels of waste water from these facilities were lower than set by the National Environmental Management Autority, NEMA, Water Quality Standards, WQS, due to high levels of affluence released into the Mara River even after the various methods of treatment had been done. The study concluded that it is prudent that awareness creation be done by the relevant NGOs and County government to sensitise the local community on the need to treat water before drinking and especially during the wet season. That there should be a strict monitoring on regulated facilities by NEMA and County government in addition to a review of water quality regulation, 2006, (Chiro, Thuo and Abila, 2020).

Recognizing Factors Affecting the Sustainability of Water Environment Treatment Public-Private Partnership Projects in China, is an investigation done by, (Li, Wen, Xia, Wang and Lelin, 2019). The study used a combination of structured interviews with industry professionals, after a review of related literature, and questionnaire-based survey for indicator choices. To assess the extent of common-method variance bias among variables, the study applied Harman one factor test, (Harman, 1976). SEM, a multivariate analysis method, was used to achieve the factor analysis together with path analysis at the same time, (Xiong, 2014). Exploratory Factor Analysis, EFA,

assisted to create factors for a measurement model by identification of patterns among the data, determine the relationship within the patterns, and data simplification.

The examination was directed utilizing a blend of organized meetings on the Likert scale with industry experts and a survey of maintainability writing. Substantial surveys were gathered, with a reaction pace of roughly 62% (124). Most respondents (39.5%) originated from investigate foundations, 17.7% from venture organizations, and 11.3% from government office. Moreover, as indicated by the quantity of PPP ventures associated with water natural treatment, most respondents (65.3%) have taken an interest in 1-2 specific ventures, trailed by those with 3–5 tasks (19.4%) and in excess of 6 undertakings (10.5%). Generally speaking, 95.2% of respondents have partaken in related tasks. Regarding work understanding, most respondents (63.7%) revealed 3–5years of work understanding, 16.9% guaranteed 6–10years, 4.0% announced 11–15years, and just 15.3% purported under 2years of work understanding.

So as to decide the conceivable nearness of normal strategy fluctuation inclination among factors, the investigation utilizes Harman, one factor test. The investigation found that the financial maintainability measurement incorporates five markers. The marker, reasonable money flow, is positioned as the most significant pointer. This showed if the venture needed money flow, the financial assets required in development and activity can't be ensured, and such condition isn't favorable. The social maintainability measurement incorporates three markers. The pointer, open fulfillment, is positioned the most significant in this gathering. People in general speaks to a significant partner who is the most immediate beneficiary and perceiver of water condition treatment PPP ventures and whose fulfillment ought to be viewed as a urgent piece of a presentation assessment framework to accomplish social maintainability advancement. Li, *et al* (2019), found that the asset and condition supportability measurement incorporates seven pointers. The pointers of effect on water quality, and, vitality efficiency, rank first and second, individually. Integrating maintainability into foundation ventures has gotten boundless consideration. Recognizing factors that affect the natural treatment PPP ventures maintainability is a significant issue that can prompt progressively feasible frameworks, in view of the triple primary concern of economy, society, and condition, in this manner coming up short on an increasingly complete assessment list framework.

A study was done by Kumar, Akkaraboyina and Belay, (2018), on Community Perception And Participation Towards Soil And Water Conservation Practices: A Case Study Of Gubalafto District Of Amhara Region, Ethiopia. An effort was made to assess the levels of perception and engagement by the community towards soil and water conservation measures. The critical information was collected from social surveys, interviews, focus group discussions, through purposive sampling technique, field observations and secondary data sources, got through stratified sampling method based on agro-ecological settings. Kothari, (2020) approach was used to determine the sample size of the study. A questionnaire response rate of 95.36% was realized. The interview and Focus Group discussion guides were translated into the the working language of the study area, Amharic language to obtain appropriate information. Descriptive and inferential data analysis were adopted and the data evaluated using SPSS version 21, the findings were yabulated and presented in the form of graphs, qualitative and quantitative discussion.

The results indicated that 66.7% of the farmers participated in the soil and water conservation practices inadvertently but for payments. The findings showed that the participation of various stakeholders was relatively poorer in the planning and monitoring stages but slightly improved at the implementation phase. The results, futher suggested that misperception about the importance of soil and water conservation was rampant within the community, and single factor ANOVA indicated that there were no remarkable variations among the three agro ecological zones of the study area on the extent of misperception. Kumar, Akkaraboyina and Belay, (2018), proposed that for effective working and to obtain better results from soil and water conservation measures, the involvement of all the stakeholders and farmers is needed during all the three phases. It is therefore necessary that appropriate measures are taken to ensure voluntary participation and to alleviate the misunderstandings fron all the concerned parties.

2.8 Monitoring and Evaluation and Sustainability of Projects

Monitoring involves the routine checking of information on progress, to confirm that the program or a given project is occurring as per the defined direction, while on the other hand, evaluation is used to ensure that the direction chosen is correct. Literature review was done to find out from previous studies the trend of the availability of M&E plan, availability of M&E results, rate of

M&E approach review and M&E trained staff. A study by, Kirsty, Hulst and Kerry, (2017), comparing theory and documented practice across Europe was designed to explore the monitoring and evaluation (M&E) aspects of three major EU policies affecting the environment: Water Framework Directive, Natura 2000 and Rural Development Programmes under the Common Agricultural Policy. The primary data collected was restructured in 'matrices' that grouped data from the various country participants. This paved way for a structured procedure of identifying patterns through comparisons across the directives and countries. The process of analysis was classified as a social qualitative analysis, since it relied on patterns based on texts and synthesis of those texts. Validity was also continuously reinforced through the process by member checking among the partners of Monitoring and Evaluation for Ecosystem Management, (MEEM). Reliability was cushioned by constant openness around the approach, coupled with continuous reflectivity on the subjectivity both during virtual meetings and the workshops. The fact that this study relied strictly on publicly available data on monitoring and the web searched by members who were not expert in this fields, may not always represent practice on the ground. However, valuable lessons came out of the analysis, since it was the availability and accessibility of monitoring data that was of interests in this case, (Kirsty, Hulst and Kerry, 2017).

Templates developed and used to assess the EU policy areas under focus guided the data collection. An initial template was developed before the workshop to structure the information collection and to help scoping key issues and differences across countries. The data collected formed the main input for discussion at the workshop in June 2017. A second template was developed to follow up on the issues identified in the work shop, a more specific and aimed at providing further information, (Kirsty, Hulst andKerry, 2017). To ensure rigour, participants were urged to provide references for the claims made in the completed templates. To ensure that partners had identified the relevant publicly available documents for completing the second template and experts consulted from their networks. To ensure comparability, the study explicitly used only publicly available documentation, even when participants, their institutions or the consulted experts could have had inside knowledge of the practical implementation of monitoring of the particular schemes.

In the analysis, the primary data collected through the templates was restructured in matrices that gathered the answers given by the different country representatives. This allowed a structured process of looking for patterns by making comparisons across the directives and across countries. The process used was a social qualitative analysis, which relies on looking for patterns based on texts and interpretation of those texts. The validity of this approach was established by a theoretically derived approach. The questions driving the templates covered issues that are considered relevant in the literature. A continuous process of member checking among the MEEM partners also strengthened validity. Reliability was addressed by a continuous transparency about the approach, continuous reflection on subjectivity both during virtual meetings and during the workshop. However, the study relied strictly on publicly available data on monitoring, which may not always represent practice on the ground. Given the wide diversity in relation to the background of countries, the analysis faced an inherent trade-off between providing detail and overview, (Kirsty, Hulst and Kerry, 2017).

The process of evaluating and authorizing new water related projects and plans is important in the context of river basin management. Up to now, evaluations have, in many cases, failed to account for sustainability concerns. Videira, Kallis, Antunen and Santos, (2000), all agree that the new Water Framework Directive will be at stake, unless the evaluation procedure of new plans and projects evolves into a new, multi-dimensional and multi-stakeholder participatory approach, Development of environmental flow objectives and subsequent development of intervention monitoring and evaluation is key in the adaptive management of environmental flows. Where monitoring has been done, it has revealed that limitations in our conceptualization of the basin may reduce the likelihood of achieving the basin scale objectives. Horne, Acreman, and Richter, (2017), stated that objective-setting is the key initial step in environmental flow planning and it subsequently provides an input into adaptation of the basin scale water management framework and provide a foundation for adaptive management of environmental flows including monitoring and evaluation. Monitoring of the environmental flows is also constrained, with many projects focusing on monitoring short-term outcomes of flow events rather than long-term responses to flow regimes.

A case study of the Bay of Quinte Remedial Action Plan: Assessing the impact of integrated research and monitoring communication tools in remediation efforts at Great Lakes - St. Lawrence River Basin Areas of Concern, done by, (Michelle, Linda and Graham, 2012). literature review, interviews, experiential learning were used to collect data to explore the issue of communicating research and monitoring information for aiding decision-making. Findings indicated that accurate tracking of trends, valuing high quality monitoring, promoting stakeholder, cooperation, collaborating with other groups implementing RAPs and informing management and decision-making are critical beneficial outcomes of shared science about the Bay of Quinte, The results emphasized the importance of administrative support and institutional memory together with integration of ecosystem models. Consistent long-term monitoring and public engagement are key. These are lessons instructive for stakeholders conducting ecosystem restoration, planning or management. Semi-structured interviews with scientists, regulators and community stakeholders involved with the Bay of Quinte RAP also observational research, document analysis and literature review were used. Findings indicated that multiple and diverse techniques need to be used to communicate research and monitoring data to decision-makers, (Michelle, Linda and Graham, 2012).

Study was done by, Yazdil, Ali, and Ata, (2017), on Monitoring and evaluation (M&E) system: An underestimated tool in reflexive governance of research evaluation. The article was based on an ongoing evaluation project of the research centres of Sharif University of Technology since early 2016. It hypothesized that elements and processes of M&E systems are lacking, skinny or at best fragmented, several semi-structured interviews were held with managers and experts having experience in governance of research. Practically, it was found that only normative research questions could be pursued and not descriptive ones, due to lack of M&E practices and processes. As part of a preliminary study for designing an M&E system for the research centres of Sharif University of Technology, the interviews revealed that there is no clear picture of the research output, outcome and impacts of the departments and the university as a whole. Not even the rudimentary elements of M&E systems were missing. The absence of such necessity is well characterised in the widespread criticism of the overarching hierarchy mode of research governance and also the crippling growth of the network mode of research governance in the university by the hegemony of the faculties. It came out that even the University was not readily

aware of its basic research financial measures, including total research income, total industry income, expenditures or license income. Participatory evaluation was identified as a missing practice, which would yield considerable results in favor of higher acceptance of M&E systems due to taking organizational resource, financial and strategic differences between research centres into account. It advocated specialised evaluation by a distributed structure and committees utilising customised evaluation indicators and processes based on different needs of each centre as an outcome of participatory evaluation. The respondents stressed on the necessity of evaluation at an organisational level to enable the stakeholders assess the current status, trends and facilitate improvements towards goals. Indeed, other levels of evaluation such as team, project or individual levels that are complementary, were also valued for a later follow up, (Yazdil, Ali, and Ata, 2017). Lastly, the interviewees did not prescribe any specific set of evaluation indicators or framework due to perceiving them as contingent upon mission, conditions and goal of evaluation. However, they suggested an evolutionary approach for the sake of practicality, to first accommodate the most available and required indicators according to the mission, strategies, budget and time constraints.

Mgoba, and Kabote, (2020), investigated the level of success in community water projects when monitoring and evaluation is done in a participatory manner, in Chamwino district of Tanzania. The study followed a sequential exploratory cross-sectional research design, that enabled data collection at a point in time, which was considered the most suitable for descriptive interpretations to determine the relationships between and among variables, (Babbie, 2007). The target population was water consumers in the government departments and non-governmental community- water projects. Four villages were sampled purposively, with community-based water projects which had practiced participatory arrangements in monitoring and evaluation on community-based water projects. Either the household head or the spouse was interrogated for data collection and triangulated with the focus group discussion, survey and key informants interaction as methods of data collection. Sex and leadership were pivotal in the choice of focus group discussions to give a new perspective to project M&E, while key informants were the well informed being continuously engaged in the water project activities. Based on the study objectives, the field data was summarized to analyze qualitative data, while Statistical Package for Social Sciences (SPSS), was used to analyze quantitative data. The Kruskal Wallis H tested the null hypothesis, which is a

nonparametric statistic used to determine the significant variations for greater than two independent groups for ordinal dependent variable, (Pallant, 2007).

The finding showed that there was an increase in water availability after the establishment of community-based water projects. In addition, it indicated that the governmental and nongovernmental financed water ventures failed to realize the objective on capacity building of the local communities to run community water projects. This deficiency among the community members to run the community water projects could endanger the sustainability project. However, to raise the level of participatory M&E effectiveness, focus ought to be on enhancing the capacity of the local communities, that of the water users associations and individual consumers to make them part of a team that manages the community water projects. Further, engagements in decision making on issues to do with water projects, engagements in water fee payments and engaging in maintenance of pumps were instrumental in the realization of capacity building among the communities to oversee the community water ventures, (Mgoba, and Kabote, 2020).

The study concluded that water projects; particularly those funded by non-governmental organizations realized the targeted objectives in ensuring functionality of the water points; to increase the availability of water; and to reduce the time used by mothers and daughters while collecting water for home usage. On the other hand, the capacity building, as one of the projects' objectives, was not realized by both governmental and nongovernmental projects. Further, overall effectiveness of participatory monitoring and evaluation on the realization of community water projects was great, particularly for the non-government water projects. The study suggested the strengthening of participatory M&E, for the governmental and nongovernmental community water projects to improve the success levels of the projects. Greater attention is given to capacity building among local communities so that they can manage the projects even without the external support. The policy therefore need to be domesticated and operationalized at all the government levels as a matter of urgency, (Mgoba and Kabote, 2020).

Muchelule and Minyiri, (2018), sought to assess the influence of monitoring and evaluation in water project output in Migori County, Kenya. The study used descriptive survey and cross-sectional design, in which, data was collected across several projects simultaneously so as to

determine the relationships among the study variables. The targeted population comprised of the community that enjoyed the water services, in addition to the employees of the water service company in Migori County. These were directors and managers, administrators and accountants, supervisors and junior staffs on top of the stakeholders who worked for the water service projects within the County. Questionnaire in-built with structured and unstructured questions was used to collect data from both primary and secondary sources. Quantitative data was analyzed descriptively using SPSS, since it is ease and best suited for analysis of attitudinal responses related to management studies.

The results showed that the bulk of the respondents who engaged in the study were male at 58.6%, whereas the female were at 41.4%. This confirmed that the study valued both genders as a source of information pertaining to the role of community engagement on water ventures success levels in Migori County. The responses were rated on a five point likert scale ranging from strongly disagree to strongly agree. The study findings unraveled that majority of the respondents confirmed that; the project resources were evenly distributed during the venture life cycle, all the staffs engaged with the projects participate in monitoring and evaluation progress, projects documentations had adequate clarity and that the company had project progressive reports. It was further revealed that when members were involved in decision-making over the entirety of the project, from design to maintenance then, the best results were obtained, but when engaged only in information sharing and consultations, then results were not at best, (Muchelule and Minyiri, 2018). The findings showed that the relationship between monitoring and evaluation and performance of water ventures, is a strong, positive and statistically a significant one. That Monitoring and evaluation raised the performance of community engagement on water venture performance in Migori County. In addition, the members attached a lesser meaning to M&E when they are not involved through the entirety of the venture cycle. Community engagement in M&E is important in project performance since it provides new perspectives in assessing and learning from a more inclusive and more responsive change to the needs and expectations of those who are more directly affected. It does not only measure the effectiveness of a project, but also enhance building of ownership, empowerment of the beneficiaries, built accountability and transparency and initiate corrective measures towards improving the performance and outcomes, (Binswanger, 2010).

2.10 Theoretical Framework

This section reviews the Game theory that will anchor the research study. It covers the proponents of the theory, when propounded, its assumptions and the relation to the study.

2.10.1 Game Theory

It is linked to the dependent variable which in this case is sustainability of projects. The proponents of game theory were Joh Von Neumann, John Nash and Oskar Morgenstern in the year, 1944. The two main assumptions are Rationality of agents and Nash equilibrium. It is a distinct and interdisciplinary approach, studies rational choices of strategies and treats the interactions among people as if it were a game, with known rules and payoffs, in the study of human behavior, and in which everyone is trying to win. Nash equilibrium is a solution concept of a non-cooperative game involving two or more players. The assumption is that each player knows the equilibrium strategies of the other players, and no player has anything to gain by changing only his or her own strategy, (Malczewski., 2006). With efficiency in the information gathering and sharing within the basin, each player understands the sustainability strategies available. If each player has chosen a strategy and none can benefit by changing strategies while the others kept theirs unchanged, then the current set of strategy choices and the corresponding payoffs constitutes a Nash equilibrium.

Game theory was originated from economics, one of social sciences and has been used in various fields including biology and applied to the realm of nature as well, (McCain Roger, 2010). It presents a technical analysis of strategies focused on the interaction of decision makers in the game. The behavior of a decision maker in game theory model is referred to as strategic and the action performed while making any move is called a strategy. Strategy takes into account how agents act, what they prefer, how they make their decisions, and their behaviors. These interactions could be critical since the action of even one agent could influence other agents and vice versa. Game theory can thus be categorised as a powerful and alternative tool for analyzing strategic interaction between economic development, in this case, land use and development, environmental protection, including water-quality protection and eutrophication control, (Chih-Sheng, 2012). Sustainability programmes in the sub-basin have both long term and short-term benefits that can be described as payoffs as a result of community members' actions and interactions. While game theory is a tool for analyzing interactions, the current study focus on the interactions between the

water resource management tools and sustainability of projects in Nyangores River sub-catchment basin. It is concluded that the game theory is relatively applicable to the field studies of water management such as cost and benefit of allocation among users, water allocation among trans-boundary users in water resources, water quality management, groundwater management, analysis of water policies, fair allocation of water resources development cost and some other narrow fields. Decision-making in environmental projects requires consideration of trade-offs between socio-political, environmental, and economic impacts, often complicated by various stakeholder views

2.11 Conceptual Framework

The conceptual framework, in this case, is used as a model to illustrate the relationship and the interactions between the variables under study and to operationalize them while keeping the research focused on its objectives, as shown in figure 1.

Independent variables

Water Resource Management

Tools

Dependent variable

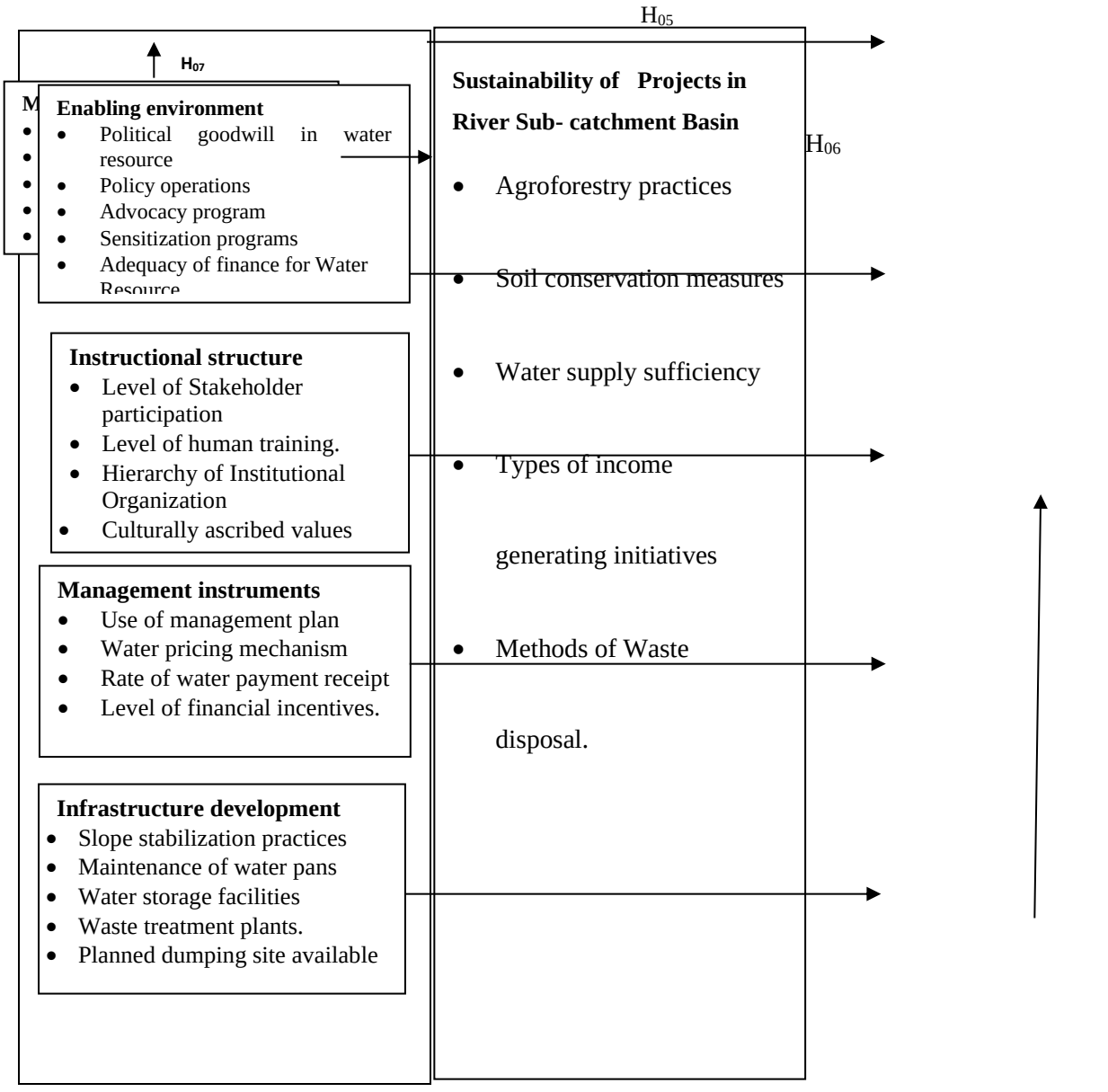

Figure 1: Conceptual Framework on Water Resource Management tools, monitoring and evaluation and Sustainability of Projects in River Sub-Catchment Basin.

Figure 1 refers to the conceptual framework to displays the conceptualized interactions of the independent variables-the enabling environment, institutional structures, management instruments and Infrastructure development, with their corresponding indicators on the left hand side of the framework and the dependent variable, sustainability of projects in Nyangores River sub-catchment basin, with its indicators on the right hand side. In between the two sides, there is monitoring and evaluation as a moderator.

The interactions occur at three levels that include the individual independent variable, each interact with the dependent variable represented by hypothesis H1, H2, H3 and H4. The 2nd level involves all the four independent variables, collectively influencing the dependent variable represented by H5. The moderator variable, M&E, directly influencing the dependent variable under H6, and finally, the moderating influence of monitoring and evaluation on the relationship between the independent variables and the dependent variable, represented by H7. The dependent variable, sustainability of projects in river sub- catchment basin, is measured by the indicators; extent of agroforestry, level of soil conservation, extent of human health and wellness, types of income generating initiatives and waste disposal methods.

2.12 Summary of Literature Review

The literature review in this study comprised of both empirical and theoretical literature reviews, theoretical framework and conceptual framework. The empirical and theoretical review explored on the sustainability of projects in Nyangores River sub-catchment basin. It was revealed that, poor administration of assets; for example, spontaneous land clearing for development and deforestation of the water towers has prompted genuine natural and biological corruption just as decreased water volumes. Soil and water preservation programs have picked up acknowledgment on the planet as a method for water the board, (Gleick, 2009). The water resource management tools which comprised of; enabling environment, institutional structure, management instruments and infrastructure development as well as monitoring and evaluation. In regard to the enabling environment, it was shown that, in spite of the fact that the stream bowl administration framework, in Kenya, was created in a participatory way with the incorporation of water specialists, nongovernmental associations, and network agents, the basic issues with the demonstration, is the

avoidance of rural poor individuals, pastoralists, and other underestimated on-screen characters from its advantages, (Robinson, 2010).

Further, related to institutional structures, it was revealed that the regular highlights of the bowl, the qualities of framework, for example, size and scale, innovation, and reason will in general decide the sort and character of institutions set up for water assets the board. As a result, the physical arrangement of the stream bowl reflects the institutional game plans. In addition, management instruments, Atef, (2014), alerts that Economic Instruments ought to be embraced depending on their capacity to add to explicit water strategy goals, including targets identified with financial productivity, social value and ecological safeguarding. The executives instruments help oversee interest for water and upgrade financial action in accordance with ecological insurance as strategy destinations. Review based on infrastructure development inferred that huge infrastructure undertakings can modify the elements of participation between riparian nations in trans-boundary stream basins, since they change capacities for water flow control and may encourage or hinder open doors for extra water withdrawals, (Marc, Wu and Dale, 2017).

Literature on monitoring and evaluation, suggested that the evaluation procedure of new plans and projects should evolve into a new, multi-dimensional and multi-stakeholder participatory approach. Development of environmental flow objectives and subsequent development of intervention monitoring and evaluation is pivotal in the adaptive management of environmental flows. Where monitoring has been done, it has revealed that limitations in our conceptualization of the basin may reduce the likelihood of achieving the basin scale objectives. Horne, Acreman and Richter, ((2017), revealed that Water is one of our most precious and valuable resources and is fundamental for maintaining human health, economic activity, and critical ecosystem functions and that potentially useful water is sourced from the water resources. As captured, mostly the human water needs require fresh water, which, in many situations is non-excludable and does not have the characteristics of classical private goods.

2.13 Knowledge Gaps

Table 2.1: Knowledge Gaps

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
Enabling environment.	Chumbulla, (2018)	The role of local institutions in the creation of an enabling environment for water project sustainability in Iringa District, Tanzania	Using mixed method approach and binary logistic regression, the study found that effective implementation of the by-laws depends largely on users' knowledge about the laws and the associated penalties.	Using mixed method, the current study intend to establish the extent of users' practical application of the water resource policy and the associated penalties for sustainability.
	Alam and Phillippe, (2014).	Evaluation of Integrated Water Resources Management (IWRM) activities, in Bangladesh	Used online questionnaire survey. Findings indicate that the National Water Policy, (NWP) has not been reviewed during the last 12 years since it failed to conceptualize the term IWRM explicitly	The current study seek to use questionnaires, focused group discussion and document review to find the frequency of water policy review in Nyangores River sub-catchment basin
	Melanie, Thandi and Rashid, (2015),	Assessing the usage of coordinated water asset management in the Inkomati River Basin,	Results demonstrated that a high number of respondents knew about water approaches set up in	The current study intends to find out the extend of Integrated Water Resource Management practices in Nyangores River Basin

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
		IRB, in S. Africa, Swaziland.	the Integrated River Basin, in Inkomati.	
	Makarius and Patrick, (2015),	Exploring the water shade sustenance and water management along Pangani river basin, Tanzania.	In the study, the key issues in focus were administrative aspects, information availability, policy application and instruments, sustenance objectives and level of accountability by the staff.	The current study intends to focus on ; political good will, financing, advocacy and representation
Institutional structures.	Melanie, Thandi and Rashid, (2015).	An assessment of the Performance of the Relevant River Basin Organization, in the Inkomati River Basin, S. Africa	Used survey and purposive sampling, found out that only a third of respondents in Swaziland have similar confidence in levels of human capacity within these local institutions	The current study intends to combine purposive and snowballing for sampling to find the level of human capacity, in terms of training and participation, within the local water institutions
	Minhaz, Mazlin and Lubna, (2020)	Investigated the Factors that Determined the People's Readiness to Engage in the Sustainability of Water Resource Management in Langat River Basin, Malaysia	Using questionnaires and informal interviews, found that environmental education would change people's mind-set to raise the awareness of water resources and their engagement in	The current study wish to use mixed method to determine the role of institutional sensitization and advocacy for sustainability of projects in Nyangores river basin

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
			water resource management.	
	Pandey, Maskey, Kamal and Ojha, (2019)	To Investigate the Institutional Landscape for Urban Water Security in Nepal	A mixed approach to primary data collection and analysis used. The multiple institutions engaged in the water management of the town, hold grievances against one another through micro-politics, creating a non-amicable relationship.	The current study intends to use mixed method approach to establish the degree of harmony within the organizational hierarchy, among the Water Institutional Structures, in Nyangores River Basin.
	Isabella, George, and Onyango, (2019)	A Study on Understanding Institutional Structures and Their Role on Climate Change Adaptation: An Instance of Mara River Basin, Kenya.	The study found that the government's weakest structures are found in the developing processes quadrant at 48% which involved; participation in decisions, skills and knowledge	The current study wish to assess the extent of stakeholder participation in decision making and training in Nyangores River sub-catchment Basin, Kenya.

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
	Khin, (2019)	Building Institutional Capacity for Water Governance: A Case Study on Integrated River Basin Management in Myanmar,	Data from open interviews, symposium and incorporating cultural issues, using constant comparative method showed high level of centralization and fragmentation in the institutional transition.	The current study intends to use open interviews, FGDs, and document analysis to examine the available species of indigenous plants and animals as an institutional component in Nyangores Sub-Catchment basin.
	Pandey, Maskey, Kamal and Ojha, (2019).	Investigating the Institutional Landscape for Urban Water Security in Nepal, Mahabharata Range.	Found that WUA don't connect with one another and instead, gossip over one another, leading to perennial failures.	Current study intends to determine the hierarchy and the harmony within and among the various water institutions, in the Basin
	Jampel, *et al*, (2016)	Community Water Projects in Likii Water Resource Users Association**.**	Using semi-structured interviews, it found that bottom-up representation provides a procedure by which the people affected by the legislation can engage in establishing or adjusting them	This study plans to establish the degree of fairness and effectiveness of representation of WRUA members in decision making, within the various Water Institutions

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
Management instruments.	Melanie, Thandi and Rashid, (2015)	Piloting a Method to Evaluate the Implementation of Integrated Water Resource Management in the Inkomati River Basin,	Primary data collected through a questionnaire. Only a small group of respondents from South Africa and Swaziland indicated that the user charges and revenues were collected monthly and annually by RBOs	The current study intends to collect both primary and secondary data to find the revenue collection and allocation for the sustenance of projects in Nyangores River Sub-catchment Basin.
	Nyika, Karuku and Onwonga, (2017).	Water Resources Inventory and Assessment for Sustainable Development,	Using two-step survey design, data from observation and ANOVA, results indicated that the failure by water company employees to do metering, coupled with corruption and bribery, explained the inconsistencies in water payments.	The current study, intends to use descriptive survey design to contribute to the fairness and effectiveness of the water charges and payments in Nyangores River Basin.
	Gustavo, *et al*, (2018)	Markets User Rights By Use Of Economic Instruments, To Assist Water Policy In Brazil.	FGDs and snowball, surveys referred to as Delphi method, were used. Data processed through several rounds of inquiry. It was found that the use of water permits should be accepted as a document to be	Using descriptive survey and correlation design, the current study wish to find the impact of fining polluters and financial incentives to those who preserve the water resource well.

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
			transferred in the market.	
	Mazlin, (2009).	An Appropriate Institutional Framework Towards Integrated Water Resources Management in Pahang River Basin, Malaysia.	FGDs, key informants and open interviews gathered data. It was found that the Federal Government needed to alter the Water Services Industry Act 2007, which moved water flexibly and sewerage administrations from the State rundown to the Federal rundown.	Using FGDs interviews and document analysis, the current study intends to examine the use of riparian management plan, in Nyagores River Basin.
	Wang, Mu and Jadwige, (2021).	Perceived Economic Value of Ecosystem Services in the U.S. Rio Grande Basin, RGB	By use of quetionnaire and Geo-spatial data-base data was collected. Linear probit model was used to determine respondent's decision. Participants showed a WTP for the river Ecosystem Services that they find most relevant to them, that is fresh water supply, in the RGB	Using Pearsons correlation coefficient, R, to test the hypothesis, the study intends to find out the extent of disputes and complains over water payments and fines for non-conservation of the ecosystem in Nyangores River Basin.

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
	Yericho, Berhanu and Meshesha, (2019).	An Investigation To Evaluate The Difficulties And Chances Of Actualizing Incorporated Water Asset The Board Mediation In Omo-Gibe Bowl, Ethiopia.	Using interviews, FGDs and key informants data were gathered and analyzed. It found that dams were utilized as spot for recreation in addition to fishing for both subsistence and selling.	The currents study, used interview, FGDs, and key informants to collect data to assess the maintenance and functionality of ponds and dams as water reservoirs within the Basin area.
	Chiro, Thuo and Abila, (2020).	Effects of Liquid Waste Management Approaches In High End Hotels, (HEH), On Waste Water Quality In Sekenani, Masai Mara Game Reserve, Kenya.	The study adopted experimental, purposive and quantitative research design. It was found that due to high levels of affluence released into the Mara River, the water quality standard was much below the NEMA standards.	The current study intends to use FGDs, open interviews and key informants, analyzed to determine the availability of waste treatment plants within the Nyangores River Basin
	Li, *et al,* (2019).	Recognizing Factors Affecting the Sustainability of Water Environment Treatment Public-Private Partnership Projects in China	The study applied Harman one factor test. The investigation found that the financial and social maintainability ranked high in the infrastructure development.	Current study, using FGDs, interviews intends to assess the use of rainwater storage facilities, water ways and wet lands to control soil erosion and conserve water in the River Basin

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
	Kumar, Akkarabo yina and Belay, (2018)	Community Perception And Participation Towards Soil And Water Conservation Practices: A Case Study Of Gubalafto District Of Amhara Region, Ethiopia.	Data was collected from social surveys, interviews, FGDs following purposive sampling technique. The study proposed that involvement of all the stakeholders is needed during all the phases, for effective working and better results from soil and water conservation measures.	The current study intends to investigate the extent of soil and water conservation, particularly on sloppy areas, using terraces, vegetative cover crop and ways of protecting the swampy areas, within Nyangores River Basin.
Monitoring and Evaluation	Kirsty, Hulst, Kerry, (2017)	Comparing Theory and Documented Practice Across Europe	The study explicitly used only publicly available documentation to explore the monitoring and evaluation (M&E) aspects of major EU policies affecting the environment.	The current study intends to use both public and classified data as far as possible to explore the M&E practices suitable for projects in Nyangores Sub-catchment Basin
	Michelle, Linda and Graham, (2012).	A case study of the Bay of Quinte Remedial Action Plan: Assessing yhe Impact of Integrated Research And Monitoring Communication Tool	Data was collected using interviews and experiential learning. Findings indicated that multiple and diverse techniques need to be used to communicate research and	The current study intends to use mixed methodology to explore on the most suitable technique to communicate M&E results to decision makers, for sustainability of projects in Nyangores Sub-catchment Basin.

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
			monitoring data to decision-makers.	
	Yazdil, Ali, and Ata, (2017).	Monitoring And Evaluation (M&E) System: An Underestimated Tool In Reflexive Governance Of Research Evaluation.	Using semi-structured interviews and normative research questions, found that participatory evaluation was identified as a missing practice, which had the potential to result in favor of higher acceptance of M&E systems.	The current study intends to use pearsons' product moment correlation to examine the influence of M&E on the sustainability of projects in Nyangores River Basin.
	Mgoba, and Kabote, (2020).	Investigating The Level of Success in Community Water Projects With Participatory Monitoring and Evaluation, in Chamwino District of Tanzania.	Using sequential exploratory cross-sectional research design. It found that to raise the level of participatory M&E effectiveness, focus ought to be on enhancing the capacity of the local communities, water users associations and individual and consumers to make them part of a team that manages the	Using open interviews, FGDs and key informants to collect data and analyze, the current study wish to examine the level of training of, availability of and involvement of the M&E trained personnel, on M&E practices.

Variable	Author (Year)	Title of Study	Findings	Knowledge Gap
			community water projects.	
	Muchelule and Minyiri, (2018).	Assessing the Influence of Monitoring And Evaluation in Water Project Output in Migori County, Kenya.	The assessment used descriptive survey and cross-sectional design. Results showed that members attached a lesser meaning to M&E when they are not involved through the entirety of the project cycle.	The current study wish to use descriptive survey and correlational research, to establish the importance attached to M&E result in management decision making in Nyangores River Sub-catchment Basin.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology that was used to conduct the study. This included: Research paradigm, research design, target population, sample size and sampling procedure, research instruments, data collection methods, data analysis technique, ethical considerations and operationalization of variables.

3.2 Research Paradigm

The study adapted a pragmatic paradigm. Cresswell, (2008), noted that a pragmatic paradigm is based on reasoning that applies both induction and deduction to enable the use of both qualitative and quantitative data in the same research study. In pragmatism, it is believed that knowledge is not only developed through careful observation and measurement of the objective reality that exist (quantitative approach) but also by seeking an understanding of the world through developing subjective meanings from the researchers own experiences and those of the subjects on the situation under study (qualitative approach). It further opines that since the world is not an absolute unity, its complete understanding demand the use of various ways to gather and analyze the data. This calls for the use of a number of methods, techniques and procedures in generating information that is used to unravel the situations.

Tashakkora and Teddle, (2003), argued that pragmatism, is the best paradigm that justifies the use of mixed methods research. A philosophy that informed the study in seeking an understanding of the association between the given variables under study, in this case, water resource management tools, as the independent variable and sustainability of Nyangores River sub-catchment Basin projects, as the dependent variable. It enabled an undertaking through objective measurement and developing meaning to the opinion and experiences of the stakeholder involvement on the relationships of the variables as gathered through the Focus group discussions. Furthermore, pragmatic paradigm allowed the study to employ both quantitative and qualitative methods suitable to specific questions within the study instruments. In addition, it enabled the study to adopt data collection tools that included interviews, observations, document reviews, hypothesis testing and use of various scales of measurement.

3.2.1 Research Design

This study adopted descriptive survey research design and correlation research design, since both descriptive and inferential data analysis were required in this study. The design enabled the researcher to propose interventions that were employed to solve the existing problems, enabled the variables measured at ordinal and interval levels to be cross-tabulated to assess the existing relationship, focus on the overall steps in conducting research with emphasis on the specific objectives formulated, the selected sample, collected data, processing and reporting. On the other hand, correlational design is the measurement of two or more factors to determine or estimate the extent to which the values of the factors were related or the change in an identifiable pattern, (Cresswell, 2008).

Using quantitative methods maximized the objectivity, replicability, and generalizability of findings, and facilitates prediction, while qualitative methods allowed the researcher to have an open mind since the design unfolded with the study. Descriptive survey research design provided an opportunity to collect empirical research data by various methods and describe the phenomenon in its state without manipulation, (Bryman, 2008). It, therefore, facilitated the discovery and understanding of the experiences, perspectives and thoughts of the respondents in their social environment. In a single study, the researcher can combine quantitative and qualitative methods, approaches and techniques to make logical inquiry of induction, deduction and abduction.

Descriptive research design is a quantitative research methodology used to unveil in-depth knowledge about a phenomenon. It enables accurate and systematic description of a population, situation or a phenomenon. It enables the investigation of one or more variables at the same time without the researchers control or manipulation. Most suitable where the aim is to identify characteristics, frequencies, trends and categories and serves well where not much is known about the phenomenon. Further, descriptive survey allows the collection of a large volume of data that can be analyzed for frequencies, averages and patterns that can be used for further research. It blends both quantitative and qualitative data to provide relevant and accurate information through self-report measures on carefully selected samples while providing a flexible approach to facilitate a study of wide variety of basic and applied research questions. Further, Nancy, Michael, and Chuck, (2014), asserted that survey research design is a time efficient method that engages the

people at the center of the research objectives, therefore enables the researcher gain an in-depth knowledge of the research problem.

Correlational research design, on the other hand, involves the analysis of two variables to investigate the possible existence of a statistically corresponding relationship between them. It purposes to identify variables that have some relationship to the extent that a change in one leads to a corresponding change, positive correlation, negative correlation or neutral correlation, in the other, (Michelle, and Crawford, 2014).

3.3 Target Population

The study targeted household heads in two sub-counties of Bomet as units of observation for the projects in Nyangores River sub-catchment basin. Bomet central has a population of 30184 households while Chepalungu Sub County, holds 26324 households. Together, this gives a total of 56508 households. (KNBS, 2009), The household head refers to the head of the family, father or mother in his absence, the eldest child in the absence of the parents, or the adult in charge of the family where children are young and parents are absent. In addition, the study also targeted two informants from each of the other stakeholders: WRUA, WRMA, Ministries of Water and Natural Resources, Agriculture and Livestock and the local Administration. This is presented in Table 3.1.

Table 3.1: Target Population

Sub-County	Wards	Households
Bomet Central	Chesoen	
	Mutarakwa	
	Ndaraweta	
	Singorwet	
	Silibwet	30,184
Chepalungu	Chebunyo	
	Nyangores	
	Siongiroi	
	Sigor	26,324
Totals	**9**	**56,508**

Table 3.1 shows the targeted population distribution by Sub-Counties. Bomet County comprises five sub-counties but the basin sub-catchment management plan, (SCMP), is well established in

the sub-counties of Bomet Central and Chepalungu. Bomet Central comprise Chesoen, Mutarakwa, Ndaraweta, Singorwet and Silibwet Wards, while Chepalungu is composed of Siongiroi, Chebunyo, Nyangores and Sigor Wards

3.4 Sample Size and Sampling Procedure

This section describes the sample size and sampling procedure used in the study. These are further discussed under the following sub-thematic areas.

3.4.1 Sample Size

Krejcie and Morgan, (1970), designed a model for determining sample sizes at different levels of confidence and margin of error. They recommend that at 95% confidence level and 5% margin of error, a sample of 381 subjects is representative for a population of 50,000 subjects. Based on this model, a sample size of 381 was selected. These comprised of 371 household heads from a population of 56508 households in the study area, in additional to 10 key informants that were sampled from the other stakeholders. These are two each, from; the WRUA sub Catchment office, WRMA regional office, Administrative unit, Ministry of Agriculture and another two from water and Forest Resources to sum up the respondents to 381.

3.4.2 Sampling procedure

The essence of sampling technique and procedures is to help the research discourse to remain objective and devoid of subjective biasness in selection of the research sample that would have potentially compromised statistical generalizations. Multi-stage sampling technique was used in this study because the research context comprised of regions that are large and complex in terms of economic engagement, climate and political organizations. Huber, (2004), asserts that multi-stage sampling technique is the most preferred sampling technique for large organizations or units with various categories or regions, in this case locations, in research situations at which the desire is to represent every sub-population in the sample. Mugenda, (2008), proposed that 30% of a population size is a sufficient representation for studies in social science research.

Multi-stage sampling technique was used to enable the researcher, select respondents through five sampling stages. This gave the respondents more reliable equal chances of being selected in a

stepwise procedure starting with purposive selection of sub-counties in which the basin management approach had been implemented for over 3 years, this formed the research population. The second stage involved the use of stratified random sampling to determine the specific administrative wards that form the sub-population for the study, from the research population. In this second stage of the sampling procedure, 30% of the Wards were selected from each sub-county, for the study. To select this 30%, all the seven wards in the study area were stratified per the sub-county, and 30% of the wards were randomly selected. The four Wards selected formed the research sub-populations.

In stratified sampling technique, a random sample is drawn from all the strata, and (Sekaran, 2003), added that random sampling respondents from each homogeneous research category, when stratified, reduces sampling error and gives a sample size that is more representative than applying simple random sampling technique uniformly across the entire research population. This sampling procedure, (Larry, 2013), added that it can also produce a weighted mean that has less variability than the arithmetic mean of a simple random sample of the entire population. From the 13 Locations, systematic sampling to obtain 30% of these locations was done in the third step that gave 5 Locations to form the sub-population. It is from this sub-population where sub-locations were randomly selected in the fourth stage to form the sub-sub-population. To realize this step, 30% of the sub-locations are randomly selected by the use of random numbers to constitute the research category of 4 sub-locations from the 13. Sekaran, (2003), opines that in sampling procedures, a minimum of 30% of sub-populations is critical for statistical analysis.

The final step involved systematic sampling of 371 households from this category of 4 sub-locations. An additional 10 interviewees from the key ministries, were purposively selected. This provided the intended 381 respondents, sufficient to represent up to 50000 subjects, (Krejcie and Morgan, 1970). The households were sampled systematically from a central point marked by a church, school or buying center and the leader of every third household north and south, and the fifth east-west were finally sampled as the respondent, until the required number is attained.
For p households, then: s=p/3717x371, where s referred to the sample size in a particular sub-location, whereas 3717 referred to the total households in the sampled sub-locations and 371 is the targeted households. This resulted in sample sizes as follows; In Kabisoge sub-location there were

1086 households, s= 371/3717x1086=108.3, therefore, 108 households were sampled. Table 3.2 shows this stepwise sampling procedure.

Table 3.2: Stepwise sampling procedure

Sub- county Purposive Sampling	**No'of H-holds**	**Wards Stratified random sampling 30%**	**Location Systematic sampling, 30%**	**Sub-Location Random numbers, 30%**	**Household Heads**	**Sample House Holds**
Bomet Central-Wards.	30184	Silibwet Ndaraweta	Itembe Kyogong Sibaiyan	Kabisoge Kapkoros	1086 1267	108 127
Chepalungu	26324	Sigor Chebunyo	Kaboson Lalaitich	Lelaitich Lugumek	652 712	65 71
Key-Informants						10
Total	**56508**					**381**

Source: (http//humdata.org. dataset, 2009)

3.5 Research Instruments

This section gives a brief description on the research instrument used in the study. Three tools were used for data collection.

i) Questionnaire

The questionnaire was the main tool for collecting data, from the house-hold heads, in this study because it offered a reliable means of gathering information on people's knowledge, attitudes, beliefs and behavioral concerns, (Boynton and Greenhalgh, 2004). The study employed both structured and unstructured questionnaire to solicit information from the respondents, after being formulated, discussed with the supervisors and other experts then a pilot study was conducted before the actual administration of the instruments. The instruments were organized as follows;

Section A, explained the background information of the respondents. Part B targeted information on the first independent variable, enabling environment, in terms of political good will, policy operations, sensitization programmes and financing. Part C sought information on the second independent variable, institutional structures, with reference to the level of human training,

institutional organization and culturally ascribed values. Part D captured information on management instruments focusing on management plan, water pricing mechanism and the rate of water payment receipts. Part E solicited information on the infrastructure development in terms of planned damping sites, number of waste treatment plants, and maintenance of water ponds and pans. Part F, targeted monitoring and evaluation that concerned M&E objectives, plan, results availability and use. The items in this parts were measured using a 5 point rating scale, in five sections, to answer the research questions, 1 to 5, each with ten statements in a Likert type of scale to increase the response rate as argued by, (Frauke, 2008). Section G addressed the sustainability of Nyangores River sub-catchment basin projects with the indicators of measurement as follows; agroforestry, soil conservation, human health and wellness, income generating initiatives and waste disposal. The questionnaire was administered to the sampled household heads in the study area.

ii) Interview Guide

In addition to questionnaire, structured interviews were used to collect in-depth information. This allowed flexibility by presenting an opportunity to restructure questions as needed, (Kothari, 2020). The interview targeted ten key informants, two from each of the five categories: local administration, WRMA, WRUA, Ministry of Livestock and Agriculture, Ministry of Water and Natural Resources. This was intended to collect data on specific variables to triangulate and add meaning to the data collected using questionnaires. The interview was face to face which gave the benefit of probing the interviewer and noting the non-verbal signs that add meaning to the process. These data enabled the triangulation of the findings in the study.

iii) Document Analysis

This involved the use of data that had already been collected, analyzed and documented by someone else, (Kothari, 2020). In this regard, materials considered were the annual projects plan, program targets and achievements, financial sources and adequacy level, M&E plans, M&E reports and other project reports. Content analysis of these reports were done to seek documented evidence for the indicators of sustainability of Nyangores River sub-catchment Basin projects. A checklist of the types of secondary material and themes that guide the data collection is attached in the instruments for data collection.

3.5.1. Pilot Testing of Research Instruments

Testing of the research instruments on a pilot sample was done using test retest method, to allow the researcher identify whether respondents understood the questions and instructions, and whether the questionnaire items carried the same meaning for all respondents, (Kelley, 2003). The instruments were pretested with a 10% of the household heads in the neighboring sub-Locations to the study area, in Chepalungu sub-county, Lelaitich and Kipsabul and in Bomet Central, Kapkoros and Sibaiyan, before the commencement of main data collection. Using 10% sample size of 381, gave 38 respondents for pilot testing the research instruments, (Mugenda, 2008). From each of the two sub-counties, a sample of 18 respondents were sampled to give 36. The other two to make 38, were filled by purposively selected informants, one from the ministry of Agriculture and Livestock and the other from the ministry of Water and Natural Resource, both considered to be more directly involved in the basin sustainability initiatives. This was the in charge of the department that more relatively delt with matters of basin activities. These sample respondents had the same characteristics with study population since they were equally stakeholders of the same river basin sub-catchment, water resource. The researcher took detailed notes on the participants' reactions to the format of the instruments and how long they took to respondent to the questionnaire items, identifying those that needed to be explained, the ease and difficulty of each item, accordingly. Answers to all the questions were scrutinized to check whether they represented the data intended for collection. The researcher, once identified, re-phrased the vague items, corrected those that needed to be corrected and ascertained the issues of content, wording, layout, length, format and instructions that were necessary, then re-submit to the same respondents to see if they were now appropriate. Once this was well done, the instruments were ready for use.

3.5.2 Validity of Research Instruments

The three types of validity that were of interest to researchers were content related, criterion related and construct validity. Testing the validity of research instruments helped the researcher to be sure that the items measured the desired constructs. Donal and Delno, (2006), defined the validity of a research instrument as the appropriateness, meaningfulness and usefulness of the research instrument in respect to the inferences a researcher intends to make. While, (Huber, 2004), defines content related validity as the content and format of the instrument; criterion related validity as the

relationship between scores obtained using an instrument and scores obtained using one or more instruments or measures; and construct validity as the nature of the psychological construct or characteristic being measured. A measure therefore, is said to possess construct validity to the degree that it conforms to predicted correlations with other theoretical propositions. To ensure construct validity, the data collection instrument was thematically organized with simple statements, and extra caution taken to avoid ambiguity. Further, the research assistants were trained to effectively guide and ensure the attributes in the various themes were accurately interpreted.

To ensure content validity, this study used the variables and their dimensions as searched in the literature, (Hogan, 2001). Further, the researcher sought the opinion of the research supervisors as experts in M&E and discussed with two experts from water resource management. All items in the instruments were reviewed and the accuracy by which they addressed the research objectives and questions assessed and adjusted accordingly. Questions were posed in the simplest way possible as well as utilizing a Content Validation Index (CVI) method to assess the validity of the instruments. The degree of item relevance rating, on a scale of four, shown below was applied to establish content validity for quantitative data.

1=Item is not relevant to the measured domain, 2=Item is somewhat relevant to the measured domain, 3=The item is quite relevant to the measured domain and 4= The item is highly relevant to the measured domain. Prior to the calculation of CVI, the proportion of items on the scale that achieved scale of three or four by all experts were categorized as Universal Agreement, UA and scored as 1, otherwise the score is given as 0. Four experts for the current study participated in the determination of CVI.

Table 3.3: The number of experts and the implication the acceptance cut-off score of CVI.

Number of Experts	Acceptable CVI-value
Two	At least 0.8
Three to five	At least 0.85
Six to eight	At least 0.83
At least nine	At least 0.78

Source: (Polit, Beck and Owen, 2007)

The degree of item relevance rating on a universal scale is shown in Table 3.4

Table 3.4: Ratings on a 10-item scale by 4 experts on a 4-point relevance scale.

Item	Expert 1	Expert 2	Expert 3	Expert 4	Experts in agreement	I-CVI	UA
1	1	1	0	1	3	0.75	1
2	1	1	1	1	4	1	1
3	1	1	1	1	4	1	1
4	1	1	0	0	2	0.50	0
5	1	1	1	1	4	1	1
6	1	1	1	1	4	1	1
7	1	1	1	1	4	1	1
8	1	1	0	1	3	0.75	1
9	1	1	1	1	4	1	1
10	1	1	1	1	4	1	1
Proportion relevance	**1**	**1**	**0.7**	**0.9**	**S-CVI/AV =**	**0.9**	**0.9**

I-CVI=Item- Content Validation Index
S-CVI=Content Validation Index based on Scale= I-CVI/Av = 0.9
S-CVI/UA= Content Validation Index based on Universal Agreement= CVI/UA=0.9
M-CVI= Content Validation Index based on Mean Proportion Relevance= (1+1+0.7+0.9)/4=0.9

Table 3.4 show a CVI of 0.9 by all the three approaches applied. This is well above the 0.85 suggested by, (Polit, Beck and Owen, 2007), and therefore, the level of validation ascertain that the survey instrument includes all the items that are relevant and excludes those not essential for the appropriate data collection. I-CVI refers to Item-level Content Validation Index. This is the proportion of content of experts giving item a relevance rating of 3 or 4. S-CVI/Av= Scale- level Content Validation Index, based on average method, the average of I-CVI scores for all items in the scale as noted by, Yaghmale, (2003). The proportion relevance is the average of relevance rating by individual expert. S-CVI/UA= Scale- level Content Validation Index, based on universal agreement method. The mean proportion relevance refer to the mean of all the experts proportional relevance.

Criterion-related validity pertains to evidence of a relationship between the attributes in a measurement tool with its performance on some other variable, (DeVon, 2007). Qualitative data was processed into manageable proportions through editing, coding, and tabulation method. The data collected was checked while still in the field to ensure that all questions were answered and omissions together with logical inconsistencies were identified and removed. For qualitative validity of instruments, expert opinions were sought from the two supervisors. This criterion should possess relevance as to what is judged to be the proper measure; freedom from bias, giving each subject an equal opportunity to score well, and reliability to mean stable or reproducible qualities, (Kothari, 2020).

3.5.3 Reliability of Research Instruments

This study, used test-retest method which involved administering the same test twice to the same group after a certain time interval has elapsed after the previous test, (Cooper and Schindler, 2008). The test re-test criterion was preferred because the respondents in this study were expected to understand the significance of the research and hence expected to willingly fill the questionnaires for the second time. In addition, Government ministries are public entities, easily accessible for re-testing the research instruments. A time lapse of two weeks was allowed between the two administrations of the research instruments to test for their reliability. Reliability Coefficients was obtained for the variables in the study and measured using Cronbach's (Alpha). Donal and Delno, (2006), defined reliability of research instruments as the consistence of scores obtained. Reliability is achieved if consistent results are obtained with repeated measurements of the same object with the same instrument.

A comparison of the test score, from pretest and retest was done by running through SPSS and a reliability coefficient obtained and compared to the Cronbach's alpha reliability coefficient. Creswell, (2008), stated that for a research instrument to be considered reliable, it should have a composite Cronbach Alpha Reliability Coefficient of at least 0.7 for all items under study. In this study, the coefficient was 0.907; therefore, revision of the instrument was not necessary. Larry, (2013), opines that Cronbach Coefficient is used to test internal consistencies of samples of a given

population when a research instrument with Likert type scales targeting multiple responses is used for data collection. Table 3.3 shows the results of Cronbach's reliability.

Table 3.5: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.907	0.908	10

From Table 3.3 the results indicate a composite Cronbach's alpha reliability statistic of 0.907 for the ten items which implies a high internal consistency and that the instrument is reliable.

3.6 Data collection procedures

Data collection stemmed from the formulation of the research proposal and questionnaire, once approved, permission was sought from NACOSTI, WRMA, and the Chiefs, through the respective sub-county commissioners, to undertake a research study. This, then paved way for research assistants training, pilot testing the instrument, organizing for travel and accommodation, funds and letters and/or visits to the local leaders to update and seek support. During the data collection, the researcher did the introduction of self and the purpose of the research with its significance to the relevant sectors. The research assistants, with the cover letter, assisting the researcher in data collection, administered the questionnaire, giving the necessary assistance to the respondents. The research was guided by a time schedule drawn by the researcher and supervised the process. The research assistants dropped and pick the questionnaires after two days, under the coordination of the researcher. This was meant to give the respondents adequate time to fill in their responses. A system of collection, coding and entry was used to check the questionnaires for completeness per item and to establish the return rate. Further re-admission, of the questionnaires, was not done since the return rate was high enough.

3.7 Data Analysis Technique

Data analysis involved examining the data collected in a survey or experiment and making decision and inferences, (Donal and Delno, 2006). A mixed methods data analysis technique was employed in this study to incorporate both descriptive and inferential data analysis.

3.7.1 Quantitative Data Analysis.

Non-parametric data was analyzed descriptively by use of measures of central tendency and measures of dispersion as the tools of data analysis. The arithmetic mean, which is the measure of central tendency statistical tool, was used for data analysis with the standard deviation as the measure of dispersion statistical tool of data analysis. Measures of central tendency, in data analysis, are used when the set of data values are finite and the data is expected to cluster around some central value, (Weisberg, 1992). Due to the relative homogeneity nature of the stakeholder community within the basin area, guided by a common socio-economic and climatic conditions, the finite research population was anticipated to be normally distributed and data expected to cluster around statistical averages. Data was, therefore measured using central tendency based on the arithmetic mean and standard deviation from the arithmetic mean. In spite of the various measures of dispersion that could be used, standard deviation was preferred in this study because statisticians often regard it as the best measure of statistical dispersion, besides expressing the variability of a given population, while, (Ghahramani, 2000), added that standard deviation also measures confidence for statistical conclusions.

3.7.2 Qualitative Data Analysis

The qualitative data collected through interviews, observations and document analysis, was presented thematically in narrative statements, as a transcript of the study, for triangulation of quantitative data, based on each objective theme of the study.

3.7.3 Inferential Analysis.

For the parametric data, Pearson's Product Moment Correlation Coefficient (r) and Stepwise Regression (R^2) analysis were used. This is a measure of the linear dependence (correlation) between two variables and can give a positive or negative value of their relationship, (Huber, 2004). Pearson's Product Moment Correlation Coefficient (r) was used in this study to analyze the linear relationship between the predictor variable and the dependent variable. Stepwise Regression (R^2) analysis was used to analyze the influence of the moderating variable on the relationship between the independent variables and the dependent variable. Stepwise Regression (R^2) involves mathematical modeling whereby the predictor variables are deliberately chosen even when it is not necessarily backed by theory, (Larry, 2013). Stepwise regression (R^2) was used for data

analysis. The values of r and R^2 were considered while interpreting the results and confidence level of 95% at minimum in the test of hypotheses was observed.

3.7.3.1 Correlation analysis

The following correlation and regression models that guided the data analysis were defined as follows;

y……. Dependent Variable

A_0, β_0, C_0… ……Constant Terms

β_1, β_2, β_3,…βn……. …..Beta Coefficients

X_1, X_2, X_3,…Xn……Predictor Variables

ε…… Error Term

Correlation Models for Research Objectives:

Model 1

Hypotheses 1: There is no significant relationship between enabling environment and sustainability of projects in Nyangores River sub-catchment basin.

Sustainability of Projects in Nyangores River sub-catchment Basin = f (Enabling Environment)

$y=A_0+\beta_1 X_{1+}\varepsilon$ ……. 3.1

Model 2

Hypotheses 2: There is no significant relationship between institutional structures and sustainability of projects in Nyangores River sub-catchment basin.

Sustainability of Projects in Nyangores River sub-catchment Basin = f (Institutional Structures)

$y=B_0+\beta_2 X_{2+}\varepsilon$ ……3.2

Model 3

Hypotheses 3: There is no significant relationship between Management instruments and sustainability of projects in Nyangores River sub-catchment basin.

Sustainability of Projects in Nyangores River sub-catchment Basin = f (Management Instruments)

$y=C_0+\beta_3 X_{3+}\varepsilon$ …….. …….3.3

Model 4

Hypotheses 4: There is no significant relationship between Infrastructure development and sustainability of projects in Nyangores River sub-catchment basin.

Sustainability of Projects in Nyangores River sub-catchment Basin = f(Infrastructure development).

$y=D_0+\beta_4 X_{4+}\varepsilon$ …… 3.4

Hypotheses 5: There is no significant relationship between water resource management tools and sustainability of Projects in Nyangores River sub-catchment Basin.

Sustainability of Projects in Nyangores River sub-catchment Basin = f(Enabling Environment, Institutional structures, Management Instruments, infrastructure development).

$$y = E_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_{4+} \beta_{13} X_1 X_3 + \beta_{23} X_2 X_3 + \beta_{33} X_3 X_3 + \beta_{13} X_1 X_3 \varepsilon \quad \ldots\ldots 3.5$$

Model 6

Hypotheses 6: There is no significant relationship between monitoring and evaluation and Sustainability of Projects in Nyangores River sub-catchment Basin.

Sustainability of Projects in Nyangores River sub-catchment Basin = f (Monitoring and Evaluation).

$$y=F_0+\beta_5 X_{5+}\varepsilon \quad \ldots\ldots 3.6$$

Model 7

Hypotheses 7: The strength of the relationship between the water resource management tools and the sustainability of projects in Nyangores river sub-catchment basin in Bomet does not depend on monitoring and evaluation

Sustainability of Projects in Nyangores River sub-catchment Basin =f(Water Resource Management Tools, monitoring and evaluation).

$$y = J_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_{14} X_1 X_4 + \beta_{24} X_2 X_4 + \beta_{34} X_3 X_4 + \varepsilon \quad \ldots\ldots 3.7$$

3.7.3.2. Regression Analysis

Simple linear regression was adopted to investigate hypotheses; H_{01}, H_{02}, H_{03}, H_{04} and H_{06}, while multiple linear regression analysis was adopted to investigate H_{05} and H_{07}.

Hypotheses 1: $H_{01;}$ There is no significant relationship between enabling environment and sustainability of projects in Nyangores River sub-catchment basin. The model summary sought to establish how enabling environment as a predictor significantly or insignificantly predicted sustainability of projects in Nyangores river sub-catchment basin

The coefficient of the constant term (Ao) and enabling environment, (β_1) were statistically significant when ($p< 0.05$). The regression model for enabling environment was;

$y=A_0+\beta_1 X_{1+}\varepsilon$ ……..3.1

Hypotheses 2: $H_{02;}$ There is no significant relationship between institutional structures and sustainability of projects in Nyangores River sub-catchment basin. The model summary sought to establish how institutional structures as a predictor significantly or insignificantly predicted sustainability of projects in Nyangores river sub-catchment basin

The coefficients of the constant term (Bo) and institutional structures, (β_2) were statistically significant when ($p< 0.05$). The regression model for institutional structures was;

$y=B_0+\beta_2 X_{2+}\varepsilon$ ……..3.2

Hypotheses 3: $H_{03;}$ There is no significant relationship between Management Instruments and sustainability of projects in Nyangores River sub-catchment basin. The model summary sought to establish how management instruments as a predictor significantly or insignificantly predicted sustainability of projects in Nyangores river sub-catchment basin.

The coefficients of the constant term (Co) and management instruments, (β_3) were statistically significant when ($p< 0.05$). The regression model for management instruments was;

$y=C_0+\beta_3 X_{3+}\varepsilon$ ……..3.3

Hypotheses 4: $H_{04;}$ There is no significant relationship between infrastructure development and sustainability of projects in Nyangores River sub-catchment basin. The model summary sought to

establish how infrastructure development as a predictor significantly or insignificantly predicted sustainability of projects in Nyangores river sub-catchment basin.

The coefficients of the constant term (Do) and infrastructure development, (β_4) were statistically significant when ($p< 0.05$). The regression model for infrastructure development was;

$y=D_0+\beta_4 X_{4+}\varepsilon$ ……..3.4

Hypotheses 5: H_{05}. There is no significant relationship between water resource management tools and sustainability of Projects in Nyangores River sub-catchment Basin. Multiple linear regression analysis was adopted to investigate the influence of combined water resource management tools on sustainability of projects in Nyangores river sub-catchment basin.

The model summary sought to establish how combined water resource management tools, as a predictor, significantly or insignificantly predicted sustainability of projects. The regression model for the combined water resource management tools was;

$y = E_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_{4+} \beta_{13} X_1 X_3 + \beta_{23} X_2 X_3 + \beta_{33} X_3 X_3 + \beta_{13} X_1 X_3 \varepsilon$

…….. ……...3.5

Hypotheses 6: $H_{06;}$ There is no significant relationship between monitoring & evaluation and sustainability of projects in Nyangores River sub-catchment basin. The model summary sought to establish how monitoring & evaluation as a predictor significantly or insignificantly predicted sustainability of projects in Nyangores river sub-catchment basin.

The coefficient of the constant term (F_0) and monitoring & evaluation, ($\beta_{6)}$ were statistically significant when ($p< 0.05$). The regression model for monitoring & evaluation was;

$y=F_0+\beta_6 X_{6+}\varepsilon$ ……..3.6

Hypotheses 7: $H_{;}$ The strength of the relationship between the water resource management tools and the sustainability of projects in Nyangores river sub-catchment basin in Bomet does not

depend on monitoring and evaluation. A multiple linear regression was adopted to investigate how M&E moderates the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin.

Using stepwise regression, the model summary sought to establish how M&E moderates the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin. The regression model was;

$$y = J_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_{14} X_1 X_4 + \beta_{24} X_2 X_4 + \beta_{34} X_3 X_4 + \varepsilon \quad \text{.....3.7}$$

3.7.4 Tests of Research Hypotheses

For empirical conclusions to be arrived at, tests of various hypotheses were conducted. Table 3.3, indicates the summary of the research objectives, research hypotheses, type of analysis and the regression model.

Hypotheses testing was done using pearson's product moment correlation coefficient. If the p-value was less than 0.05, the null hypotheses was rejected. Regression models were used to test the strength of the independent variables on the relationship with the dependent variable. The contribution of each of the water resource management tools on sustainability of projects in Nyangores River sub-catchment Basin was determined using the coefficient of determination.

Table 3.6: Summary of Research Hypotheses Tests

Objectives	Hypothesis	Type of Analysis	Regression Model	Where to reject or Fail to reject
1) To establish the extent to which enabling environment influence the sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	1. Ho: There is no significant relationship between enabling environment and sustainability projects in Nyangores river Sub-catchment basin in Bomet, Kenya.	Simple linear regression analysis	$y = A_0 + \beta_1 X_1 + \varepsilon$ y= dependent variable β_0=Constant term β_1= Beta coefficient χ_1=Enabling Environment ε=Error term	If p less than 0.05, reject H0, otherwise, fail to reject
2) To determine the extent to which institutional structures influence the sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	2. Ho: There is no significant relationship between institutional structures and sustainability of projects in Nyangores river Sub-catchment basin in Bomet, Kenya.	Simple linear regression analysis	$y = B_0 + \beta_2 X_2 + \varepsilon$ y= dependent variable β_0=Constant term β_2= Beta coefficient χ_2=Institutional structure ε=Error term	If p less than 0.05, reject H0, otherwise, fail to reject
3. To examine the extent to which management instruments influence the sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	3. Ho: There is no significant relationship between management instruments and sustainability of projects in Nyangores river Sub-catchment basin in Bomet, Kenya.	Simple linear regression analysis	$y = C_0 + \beta_3 X_3 + \varepsilon$ y= dependent variable β_0=Constant term β_3= Beta coefficient χ_3=Management instruments ε=Error term	If p less than 0.05, reject H0, otherwise, fail to reject
4. To establish the extent to which inftrastructure development influence the sustainability of projects in in Nyangores river sub-catchment basin in Bomet county, Kenya.	4. Ho: There is no significant relationship between infrastructure development and sustainability of projects in Nyangores river Sub-catchment basin in Bomet, Kenya.	Simple linear regression analysis	$y = D_0 + \beta_4 X_4 + \varepsilon$ y= dependent variable β_0=Constant term β_4= Beta coefficient χ_4=Infrastructure development ε=Error term	If p less than 0.05, reject H0, otherwise, fail to reject

Objectives	Hypothesis	Type of Analysis	Regression Model	Where to reject or Fail to reject
5. To examine the extent to which the combined water resource management tools influence the sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	5. Ho: There is no significant relationship between the combined water resource management tools and sustainability of projects inNyangores river sub-catchment basin in Bomet, Kenya	Multiple linear regression analysis	$y = E_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_{13} X_1 X_3 + \beta_{23} X_2 X_3 + \beta_{33} X_3 X_3 + \varepsilon$	If p less than 0.05, reject H0, otherwise, fail to reject
6. To assess how monitoring and evaluation influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	6. There is no significant relationship between monitoring and evaluation and Sustainability of Projects in Nyangores River sub-catchment Basin.	Simple linear regression analysis	$y=F_0+\beta_5 X_{5+}\varepsilon$ y= dependent variable F_0=Constant term B_5= Beta coefficient X_5=Monitoring and Evaluation ε=Error term	If p less than 0.05, reject H0, otherwise, fail to reject
7. To determine the moderating influence of monitoring and evaluation on the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	7. Ho: The strength of the relationship between the water resource management tools and the sustainability of projects in Nyangores river sub-catchment basin in Bomet does not depend on monitoring and evaluation	Multiple regression Step1; Independent and dependent variables. Step 2; Moderating and dependent variables. Step 3; Moderating, independent and dependent variables.	$y = J_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_6 X_6 + \beta_{16} X_1 X_6 + \beta_{26} X_2 X_6 + \beta_{36} X_3 X_6 + \varepsilon$	If p less than 0.05, reject H0, otherwise, fail to reject

3.8 Ethical Considerations

Informed consent, confidentiality, anonymity and the participant right to privacy are some of the measures used to ensure that the participant, respondent or subject would be treated with principle of respect of the person, beneficence and justice. Cooper and Schindler, (2008), argued that research must be designed to ensure that a respondent does not suffer physical harm, discomfort, pain, embarrassment, or loss of privacy. Confidentiality was achieved by ensuring that no identifying information is sought, respondents did not need to indicate their real names on the questionnaires. The research assistants were not only trained to administer the questionnaire but also on the need to respect the respondents' privacy and personal dignity. Homesteads were accessed through the formal entrance in the company of the village administrator or the representative, who would introduce the researcher before formal identification documents are presented. The respondent was informed on the purpose of the study and how the findings would be used to enable the respondent make an informed choice, either to voluntarily participate or otherwise. The choice taken was always respected.

3.9. Operationalization of variables

The purpose of this section was to explicitly specify variables in a way that makes measurement of variables, easier. The variables of each objective were clearly identified together with their corresponding indicators, as shown in the Table 3.4

Table 3.7: Operational Definition of Variables

Objective	Variable	Indicator	Measurement	Measurement Scales	Types of data analysis	Tools of data analysis
To establish the extent to which enabling environment influence the sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	Enabling Environment	• Political goodwill in water resource • Policy operations • Advocacy/Sensitization programs • Availability of finance for WR	• Level of politician's participation • Extent of policy availability and use. • Number of meetings • Frequency of members' attendance • Sources of finance • Level of sufficiency of finance.	Ordinal Interval	Non-Parametric and Parametric	Mean/ standard deviation Simple regression model Pearson's product moment correlation
To determine the extent to which institutional structures influence sustainability of Projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	Institutional Structures	• Level of Stakeholder participation • Level of human training. • Type of Institutional Organization • Level of culturally ascribed values	• Level of representation • Availability of training opportunity • Number of trained persons • Levels of institutions • Number of culturally preserved species	Ordinal Interval	Non-Parametric and Parametric	Mean/ standard deviation Simple regression model

Objective	Variable	Indicator	Measurement	Measurement Scales	Types of data analysis	Tools of data analysis
To examine the extent to which management instruments influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya	Management Instruments	• Availability of management plan • Water pricing mechanism • Rate of water payment receipt • Level of financial incentives	• Level of availability of management plan. • Frequency of use/ reference. • Level of payment collection. • Number of financial motivations targeted	Ordinal Interval	Non-Parametric Parametric	Mean/ standard deviation Simple linear regression anaysis Pearson's product moment correlation
To establish the extent to which infrastructure development influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	Infrastructure development	• Extent of Slope stabilization practices • Level of maintenance in built infrastructure • Number of water storage facilities • Natural infrastructure	• Terraced slopes. • Vegetated slopes. • Water storage facilities. • Waste water treatment plants	Ordinal Interval	Non-Parametric Parametric	Mean/ standard deviation/ Simple linear regression analysis Pearson's product moment correlation

Objective	Variable	Indicator	Measurement	Measurement Scales	Types of data analysis	Tools of data analysis
To establish the extent to which infrastructure development influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	Combined water resource management tools	• Political goodwill in water resource • Policy operations • Advocacy/Sensitization programs • Availability of finance for WR • Level of Stakeholder participation • Level of human training. • Type of Institutional Organization • Level of culturally ascribed values • Availability of management plan • Water pricing mechanism • Rate of water payment receipt • Level of financial incentives • Extent of Slope stabilization practices • Level of maintenance in built infrastructure • Number of water storage facilities • Natural infrastructure	• Level of politician's participation • Extent of policy availability and use. • Number of meetings • Frequency of members' attendance • Sources of finance Level of sufficiency of finance • Level of representation • Availability of training opportunity • Number of trained persons • Levels of institutions Number of culturally preserved species • Level of availability of management plan. • Frequency of use/ reference. • Level of payment collection. • Number of financial motivati Terraced slopes. • Vegetated slopes. • Water storage facilities. Waste water treatment plants ons targeted	Ordinal Interval	Parametric Non-Parametric	Multiple linear regression analysis Pearson's product moment correlation

Objective	Variable	Indicator	Measurement	Measurement Scales	Types of data analysis	Tools of data analysis
To assess how monitoring and evaluation influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.	Monitoring and Evaluation	• Use of M&E plan • Objectives of M&E • Utilization of M&E results • Rate of M&E approach review • Number of M&E trained staff	• Availability of M&E plan • Availability of M&E results. • Rate of M&E approach review • M&E trained staff.	Ordinal Interval	Parametric Non-Parametric	Mean/ standard deviation/ Simple linear regression analysis Pearson's product moment correlation

Objective	Variable	Indicator	Measurement	Measurement Scales	Types of data analysis	Tools of data analysis
To determine the moderating influence of monitoring and evaluation on the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya	Monitoring and Evaluation.	• Availability of M&E plan • Structure of M&E • Availability of M&E results • Use of M&E results • Rate of M&E approach review	• Level of availability of M&E plans. • Level of clarity of M&E objectives. • Level of results availability. • Level of use of M&E results. • Frequency of M&E approaches review. • Availability of M&E experts • Level of M&E facil ities.	Ordinal Interval	Parametric Non-Parametric	Multiple linear regression analysis Step wise regression Pearson's product moment correlation
	Sustainability of projects	• Agroforestry practices • Soil and water conservation • Water supply sufficiency • Waste water disposal methods	• Level of agroforestry practices • Level of soil and water conservation • Frequency of water born diseases • Proportion of income generating activities	Ordinal Interval	Parametric Non-Parametric	Mean Standard deviation

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION, INTERPTRETATION AND DISCUSSION

4.1 Introduction

This chapter presents the study results analyzed and discussed thematically based on the study objectives. These themes are: Questionnaire Return Rate, Demographic information of the respondents, Diagnostic Tests, Sustainability of Projects in Nyangores River Sub-catchment Basin, Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin, Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin, Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin, Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin, Combined, Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin, Moderating Influence of Monitoring and Evaluation on the relationship between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin.

4.2 Questionnaire Return Rate

A total of 371 questionnaires were given out to the respondents to fill, but only 321(86.5%), were duly filled and returned. This rate of return was due to the researcher's effort to continuously encourage the respondents to fill in the questionnaires and the research assistance to reach the respondents and pick the dully filled questionnaires. Nulty, (2011), suggests that a questionnaire return rate of 75% is sufficient for data analysis and drawing conclusions and inferences. This realization enabled the researcher to proceed with the data analysis and make inferences, accordingly.

4.3 Background Information of the Respondents

The study was interested to understand the characteristics of the people participating in the research. The respondents' background information was based on gender, length of stay within the basin area and the role played in WRUA. Data was collected on whether the respondent was a male or female, to show the gender distribution among the heads of the families within the basin area, as it has a bearing on decision making on the basin activities, within the family, that

influence sustainability of projects in Nyangores River Sub-catchment Basin. Table 4.1 show the background information of the respondents.

Table 4.1: Background Information of the Respondents

Gender	Frequency	Percent
Male	209	65.1
Female	112	34.9
Total	**321**	**100.0**
Sub county of Respondents		
Bomet Central	189	58.9
Chepalungu	132	41.1
Total	**321**	**100.0**
Length of Respondents Stay		
1 to 5 years	47	14.6
6 to 10 years	61	19.0
11 to 15 years	27	8.4
16 to 20 years	15	4.7
Over 20 years	171	53.3
Total	**321**	**100.0**
Role of Respondents		
WRUA member	185	57.6
WRUA committee	17	5.3
Business member	90	28.0
Government officer	18	5.6
Institutional employee	11	3.4
Total	**321**	**100.0**

4.3.1 Distribution of Respondents by Gender

The results in Table 4.1, showed that 112(34.9%), of the respondents were female heads of the family and 209(65.1%), were male heads of the family. The lower incidence of female family heads, is explained by the rural African cultural set up in which the family head is normally a male, and female only heads' in the absence of the male counterpart. Since gender was not a consideration in this study, this parity could not interfere with the results analysis. The results met the one-third gender rule as per the constitution of Kenya, the researcher proceeded in pursuit of the study as envisaged. However, the participation of both male and female brings out the various unique perceptions that broaden the base of sustainability of projects in Nyangores River Sub-Catchment Basin.

4.3.2. Distribution of Respondents by sub county of Residence.

The study targeted residents in two sub-counties of Bomet county, namely; Bomet Central and Chepalungu sub-counties, being the immediate beneficiaries of the river basin. In Bomet Central, 235 respondents were sampled but only 189(79.4%), dully participated in the data provision, whereas in Chepalungu sub- county, 136 were sampled from which, 132(94.9%) dully participated. However, this outcome met the 75% response threshold, for data analysis, in either of the sub-counties as suggested by, (Nulty, 2011). This high response implies that the data collected can reliably be used to assess the sustainability of projects in the Basin area.

4.3.3. Distribution of Respondents by Length of Stay in the WRUA Basin.

The respondents were asked to indicate how long they had lived as WRUA members. This was considered as important since it determines the level at which they appreciate the concept of sustainability and the practices that lead to its realization. The results showed that, 47(14.6%) of the respondents had lived within Nyangores River Basin for a period of 1 to 5 years, 61(19.0%) had lived as WRUA members for a period of 6 to 10 years, 27(8.4%), had stayed for a period of 11 to 15 years, 15(4.7%) had lived for a period of 16 to 20 years and 171(53.3%), the majority, had lived for over 20 years. Cummulatively, 274(85.4%), had lived in the basin are for a period of over five years, which implied that the great majority of the respondents, understood the principles and practices of projects sustainability within the basin area. Given that about 213(66.4%), have stayed in the WRUA for between 11 to 20 years, further confirms that the respondents fully understood the situation on projects sustainability and expected to have done the best to realize it within the Nyangores River Basin.

4.3.4. Distribution of Respondents as per Roles Played

Respondents were asked to indicate their roles within the basin. This would indicate the extent to which their roles, directly or indirectly, contribute to the basin activities and to the sustainability of projects in particular. The results showed that 185(57.6%) were there as WRUA members, another 17(5.3%) were WRUA committee in addition to being WRUA members. These two categories work and contribute directly, from the bottom of the hierarchy, to the sustenance of projects in Nyangores River basin. From the business community, within the basin area, there were 90(28.0%) respondents, 18(5.6%) were present as government employees and another 11(3.4%) responded as institutional employees within the basin area.

Since, about 202(62.9%) are directly involved in the basin activities as beneficiaries, then, the commitment to sustainability of projects in the basin is expectedly high. This implied that the respondents were directly linked to sustenance practices and hence the data collected was valid.

4.4 Diagnostic Tests

Several statistical tests were carried out to establish the normal distribution of data before the analysis is done. The tests done include: Testing for normality of research data, using Kolmogorov-Smirnov and Shapiro Wilk test, Linearity tests and Multicollinearity for the variables. The following sub-themes offer further discussions on these tests.

4.4.1. Test for Normality of Research Data

One assumption for linear regression analysis is that, the data under consideration ought to be normally distributed, to realize this goal the study used the Shapiro Wilk test. Normal distribution of data is a key assumption for many statistical procedures such as t-test, linear regression analysis and analysis of variance among others. When normality assumption is violated, validity and reliability of statistical inferences are highly compromised. Kolmogorov-Smirnov test, Shapiro Wilk test, Lillierfors test and Anderson Darling test are the four formal tests for normality. Razali, (2011), opines that Shapiro Wilk, (W) test is the most versatile. Further Shapiro Wilk test is recommended for small samples, n< 2000, in this study, the sample n=321. When W value is 1, then the data is perfectly normal, for values near 1, therefore, the data is assumed to be normally distributed. In this study the values of W-statistic ranged between 0.968 and 0. 993. This indicated that the data used in this study is near perfect normal distribution and therefore normally distributed.

Table 4.2: Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests

Variables	Kolmogorov-smirnov Statistic	df	Sig.	Shapiro-wilk Statistic	df	Sig.
Sustainability of Projects.	0.105	321	0.000	0.968	321	0.000
Enabling Environment	0.049	321	0.065	0.993	321	0.125
Institutional Structures	0.051	321	0.044	0.977	321	0.000
Management Instruments	0.065	321	0.002	0.983	321	0.001
Infrastructure Development	0.085	321	0.000	0.974	321	0.000
Monitoring and Evaluation	0.098	321	0.000	0.985	321	0.002

a. Lilliefors Significance Correction

The results in Table 4.2, showed that sustainability of projects, enabling environment, institutional structures, management instruments, infrastructure development and monitoring and evaluation were normally distributed since all the corresponding W statistic are near 1.

4.4.2. Multicollinearity Test

Multi-collinearity is caused by inter-correlation among the independent variables. These variables were therefore subjected to multicollinearity test to obtain correlation coefficients between pairs of the variables. Multicollinearity exist when two or more explanatory variables are linearly related in a statistical model, this is in line with, (Alin, 2010). Where multicollinearity exists, it makes it hard to build regressional model between the response variable and the predictor variable. The correlation coefficients, in a correlation matrix, and Variance Inflation Factor, (VIF) were examined for any significant multicollinearity occurrence. VIF value greater than 10 is an indication of significant multicollinearity. For VIF values less than 10, the multicollinearity is not significant. The results are shown in Table 4.3.

Table 4.3: Collinearity Statistics

Variable	Tolerance	VIF
Enabling Environment	0.532	1.879
Institutional Structures	0.447	2.236
Management Instruments	0.471	2.124
Infrastructure Development	0.631	1.584
Monitoring and Evaluation	0.754	1.325

Table 4.3 shows VIF. All the variance Inflation Factors are less than 10, which indicates that there was no significant multicollinearity problem among the variables in the study. These results are again checked by a correlation matrix in Table 4.4.

Table 4.4: Correlation Matrix for Independent Variables

Variable		Enabling Environment	Institutional Structures	Management Instruments	Infrastructure Development	Monitoring and Evaluation
Environment Enabling	Pearson Correlation	1.000	0.635	0.571	0.399	0.430
	Sig. (2-tailed)		0.000	0.000	0.000	0.000
	n	321	321	321	321	321
Institutional Structures	Pearson Correlation	0.635	1.000	0.650	0.516	0.423
	Sig. (2-tailed)	0.000		0.000	0.000	0.000
	n	321	321	321	321	321
Management Instruments	Pearson Correlation	0.571	0.650	1.000	0.567	0.394
	Sig. (2-tailed)	0.000	0.000		0.000	0.000
	n	321	321	321	321	321
Infrastructure Development	Pearson Correlation	0.399	0.516	0.567	1.000	0.355
	Sig. (2-tailed)	0.000	0.000	0.000		0.000
	n	321	321	321	321	321
Monitoring and Evaluation	Pearson Correlation	0.430	0.423	0.394	0.355	1.000
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	
	n	321	321	321	321	321

. Correlation is significant at the 0.05 level (2-tailed).

Multicollinearity is a significant problem if the value of correlation coefficient is large, (Siegel, 2016). The threshold of 0.9 is normally considered a significant correlation. Table 4.4 indicate

that all the correlation coefficient values were way below 0.9, which implies that there were no significant multicollinearity among the variables.

4.4.3. Linearity Tests

Linear relationships between two or more variables need to be ascertained before performing linear regression, (Tabachnick and Fidell, 2013).The dependent variable, sustainability of projects was used to test the relationship it has with the independent variables and moderating variable; enabling environment, institutional structures, management instruments, infrastructure development and monitoring and evaluation. It came out that, the variables had a linear relationship, hence possible to carry out linear inferential analysis. Correlation analysis was done for each independent variable and dependent variable and the results are shown in the corresponding Correlation Analysis tables under each and every independent variable. ANOVA tests were done to establish if significant deviation from linearity was greater than 0.05 in order for the relationship between independent variables to be confirmed.

4.4.4. Likert Scale as a Measure

In this study, likert type of scale was adapted, from 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. Items, questions or statements were grouped together to measure a given variable. A composite score of the mean and standard deviation was determined as a measure of central tendency and disper sion respectively for the appropriate descriptive statistics. As stated by, Ankur, Kale, and Satish, (2015), that although likert scale data is categorized as ordinal, it is still deficient on the basis of exact interval between any two adjacent data points. However, to facilitate the performance of parametric tests by way of Pearson Product Correlation Coefficient, using SPSS software program, the coded likert measures were run and converted to interval level of measurements that gave the composite mean and standard deviation score for a given variable, together with further statistical tests that included correlation and regression.

4.5. Sustainability of Projects in Nyangores River Sub-catchment Basin

This was the dependent variable in this study. The data collected on the dependent variable, sustainability of projects was analyzed both quantitatively and qualitatively. The study sought to establish the opinion of the respondents on various aspects of the sustainability of projects; agroforestry practices, in terms of prioritization of agroforestry and tree seedlings, soil conservation measures, in terms of terracing and cover crops, water supply sufficiency in terms of adequacy and fitness for domestic use, types of income generating initiatives, in terms of economic activities such as fish ponds and crop irrigation practices, and methods of waste disposal which include, waste treatment and availability of disposal points. The likert scale was rated as 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree and 5-Srongly Agree. Table 4.5 shows the results.

Table 4.5: Sustainability of Projects in Nyangores River Sub-catchment Basin

	SD	D	N	A	SA	Mean	SD
All the waste, within the basin area, are treated before disposal.	71	77	41	70	62	2.92	1.45
	22.1%	24.0%	12.8%	21.8%	19.3%		
There are many high income-generating initiatives within the basin area.	63	78	53	99	28	2.85	1.29
	19.6%	24.4%	16.5%	30.8%	8.7%		
Water for domestic use is always safe and fit for human consumption	52	67	44	115	43	3.09	1.32
	16.2%	20.9%	13.7%	35.8%	13.4%		
Water supply is inadequate during low rain season	65	129	36	53	38	2.60	1.30
	20.2%	40.2%	11.3%	16.5%	11.8%		
Besides domestic use, water is also used in other productive projects, like fishponds, irrigations, commercial ventures.	72	55	35	122	37	2.99	1.38
	22.4%	17.2%	10.9%	38.0%	11.5%		
Water re-use is often practiced to conserve water.	79	80	43	81	38	2.75	1.38
	24.6%	24.9%	13.4%	25.2%	11.9%		
There is sufficient water supply all the time for all purposes	76	76	38	91	40	2.82	1.39
	23.7%	23.7%	11.8%	28.3%	12.5%		
Most basin activities disregard soil conservation measures.	39	103	52	72	55	3.00	1.31
	12.1%	32.2%	16.2%	22.4%	17.1%		
Soil is always conserved while undertaking farm practices.	42	68	34	136	41	3.21	1.27
	13.1%	21.2%	10.6%	42.4%	12.7%		
Agroforestry practices are not prioritized.	37	139	41	63	41	2.79	1.25
	11.5%	43.3%	12.8%	19.6%	12.8%		
Agroforestry practices are well in place.	76	54	45	114	32	2.91	1.37
	23.7%	16.8%	14.0%	35.5%	10.0%		
Composite mean and standard deviation						**2.90**	**0.62**

Based on Table 4.5, **t**he mean and standard deviation of the ten items were used to measure the sustainability of projects in Nyangores River Sub-catchment Basin. This resulted in the

composite mean and standard deviation of 2.9026 and 0.61744, respectively. Item one, all the waste, within the basin area, are treated before disposal, out of 321 respondents, 71(22.1%) strongly disagreed, 77(24.0%) disagreed, 41(12.8%) expressed a neutral view, 70(21.8%) agreed and 62(19.3%) strongly agreed. This gave line item mean of 2.92, slightly higher than the composite mean and standard deviation of 1.455 again higher than the composite SD value of 0.6174 This implies that, however divergent the respondents views are, the practice of treating waste before disposal raise the sustainability of projects in the basin area. While 45.1% of the respondents indicated that waste is not treated before disposal, within the basin area, this supports the findings by, (Huimin, Qing, Shiping, Lunyan, and Lelin, 2018), who found that appropriate management of water pollution can increase the value of lands and the project and promote area-wide economic development.

Item two, there are many high income-generating initiatives within the basin area, out of 321 respondents, 63(19.6%) strongly disagreed, 78(24.3%) disagreed, 53(16.5%) were neutral, 99(30%) agreed while the remaining 28(8.7%) strongly agreed. The line item mean was 2.85; slightly lower than the composite mean of 2.9026 and standard deviation of 1.291, higher than the composite value of 0.62. This implies that a refocus in income generating initiatives, may improve the sustainability of projects in the river basin. This agrees with the findings in a study by Huimin, *et al,* (2018), who found that cash flow, as an indicator was ranked as the most important one since any project that lacks cash flow, cannot guarantee the financial resources needed in establishment and operation leading to a non-conducive condition. It also implied divergent views exist given higher line standard deviation od 1.291than composite standard deviation of 0.62

The third item, Water for domestic use is always safe and fit for human consumption, out of 321 respondents, 52(16.2%) strongly disagree, 67(20.9%) disagreed, 44(13.7%) were neutral, 115(35.8%) agreed and 43(13.4%) strongly agreed. The resulting line item mean of 3.09 and standard deviation, (SD), of 1.32 are relatively higher than their corresponding composite mean value of 2.9026 and SD of 0.62. It indicates that the waste disposal and treatment has improved the environment and minimized the possible pollution of water sources. It confirms that spring protection projects ultimately improve the human and animal health by providing safe and

fitting water and other products for livelihood within the basin. However, a high line item SD of 1.32 than composite SD of 0.62 indicate divergent opinion of the respondents

Item four, water supply is inadequate during low rain season, out of 321 respondents, 65(20.2%) strongly disagree, 129(40.2%) disagreed, 36(11.2%) were neutral, 53(16.5%) agreed and 43(13.4%) strongly agreed. The line item mean in this case was 2.60, less than the composite mean of 2.9026 and the corresponding SD was 1.301 higher than the composite SD value of 0.61744. There is an indication of water supply not sufficient even during the low rain season that negatively contributes to the project sustenance within the basin area. Further, the higher line SD of 1.30 than the composite SD of 0.62, indicates that the respondents' opinions are divergent on this aspect. This concurs with, Al-Damkhi, Abdul-Wahab, and Al-Nafisi, (2009), who jointly noted that increasing number of developing countries are faced with water deficiency, for various reasons such as scarcity of natural water resources, populace increase, rising standards of living, and poorly developed infrastructure supply. Further, added that water sustainability is critical for both humans and environmental health,

Item five was; besides domestic use, water is also used in other productive projects, like fishponds, irrigations, commercial ventures, out of 321 respondents, 72(22.4%) strongly disagree, 55(17.1%) disagreed, 35(10.9%) were neutral, 122(38.0%) agreed and 37(11.5%) strongly agreed. This line item mean of 2.99 and SD of 1.384 were higher than their composite mean of 2.90 and SD of 0.62, respectively. This demonstrates that water as a resource greatly and positively contributes to the projects sustenance, that includes aquaculture and crop farming for both subsistence and economic gains. It indicates that water is critical for projects' success within the basin area. However, the higher line item standard deviation of 1.38 than the composite SD of 0.62, shows divergent opinion of the respondents. (Almedeij, 2007), in a study done in China, also found that water deficiency, if not addressed in a prompt and sustainable manner, will result in inevitably adverse effects on socio-economic and ecological development.

Sixth item, water re-use is often practiced to conserve water, 79(24.6%), strongly disagreed, 80(24.9%), disagreed, 43(13.4%) were neutral, 81(25.2%), agreed and finally, 38(11.9%)

strongly agreed with the line item. The line item mean was 2.75, less than the composite mean of 2.9026 which implied that water re-use has not been applied as a strategy for sustenance, while the line item SD was 1.38 higher than the composite value of 0.62 indicating divergent opinions of the respondents. This failure to practice water re-use as a strategy in Nyangores river sub-catchment basin disagrees with the findings in Mbagathi subcatchment situated in Nairobi metropolitan, Kenya, by Nyika, Karuku and Onwonga, (2017), which concluded that re-using water was the most mainstream preservation strategy since it was modest and viable.

Seventh item, there is sufficient water supply all the time for all purposes, out of 321 respondents, 76(23.7%) strongly disagreed, 76(23.7%) disagreed, 38(11.8%) expressed a neutral view, 91(28.3%) agreed and 40(12.5%) strongly agreed. This line item produced a mean of 2.82, less than the composite mean value of 2.90 while the SD of 1.39 is much higher the composite SD value of 0.62. The lower mean shows that, although water may be available, it is not always plenty and sufficient for all purposes at all points of need. There is need, therefore, for prioritization of the water allocation, particularly during the low supply periods for the sustenance of projects in the basin area. Again, the higher SD of 1.39 against the composite S.D. of 0.62, confirms the divergence of opinions from the various stakeholders.

Item eighth most basin activities disregard soil conservation measures, out of 321 respondents, 39(12.1%) strongly disagreed, 103(32.1%) disagreed, 52(16.2%) expressed a neutral view, 72(22.4%) agreed and 55(17.1%) strongly agreed. The line item mean of 3.00 and SD of 1.312 are higher than the composite values of 2.90 and 0.62 respectively. Basin activities, particularly in the farms, need to be focused on soil conservation as a method of projects sustenance. Evidently, ignoring conservation measures will be detrimental to sustenance. The composite SD of 1.31, higher than the line SD of 0.62 indicates the divergent opinion of the respondents.

Item nineth, soil is always conserved while undertaking farm practices, out of 321 respondents, 42(13.1%) strongly disagree, 68(21.2%) disagreed, 34(10.6%) were neutral, 136(42.4%) agreed and 41(12.8%) strongly agreed. The line item mean and standard deviation was 3.21 and 1.28 respectively. The higher item mean and standard deviation, relative to the composite mean values of 2.90 implies that conserving soil while undertaking farm practices, by the

WRUA members, positively influence sustenance of the various projects in the basin area. However, the higher line SD of 1.28 than the composite SD of 0.62 indicates divergent views of the respondents.

The tenth item, out of 321 respondents, 76(23.7%) strongly disagreed that Agroforestry practices are well in place, 54(16.8%) disagreed, 45(14.0%) were neutral, 114(35.5%) agreed and 32(10.0%) strongly agreed. The line item mean of 2.91 and SD of 1.37 are greater than the composite values. This suggests that the agroforestry practice, put in place by the WRUA members, positively contribute to the sustenance of projects in the basin area. This concurs with a study by, Jama, Evasu and Magosti,(2006) who found out that, the service functions of trees are numerous and include improving soil fertility, conserving soil moisture and improving micro-climate resulting in increased crop yields. The opinion of the respondents were diverse as shown by the higher line item SD of 1.37 than the composite value SD of 0.62

The eleventh item was; agroforestry practices are not prioritized, out of 321 respondents, 37(11.5%) strongly disagree, 139(43.3%) disagreed, 41(12.8%) were neutral, 63(19.6%) agreed and 41(12.8%) strongly agreed. The line item mean of 2.79, less than the composite mean of 2.90 indicate that agroforestry practices, when prioritized, lead to the sustenance of projects in the basin area. The line SD of 1.25, higher than the composite SD of 0.62 indicates the divergent views of the respondents. Farm trees and tree nurseries need to be established to support the farms and other projects by the WRUA members. This agrees with (Snapp, 2005), who aserted that agroforestry describes land use systems where trees are grown in association with agricultural crops, pastures or livestock - and there are usually both ecological and economic interactions between components of the systems. These were further confirmed by a WRUA official, who were interviewed had this to say;

> "*WRUA gives seedlings to its members including bamboo trees to plant around the water springs while the county government also provide seedlings from their nurseries for riparian protection, also used to rehabilitate degraded sites. Waste disposal is done by KTDA though insufficient. In the rural areas, members are encouraged to have pits and stores for domestic waste. Car washing is done even in the rivers, polluting the water. There are efforts to control, even at times*

culprits taken to court, though seldom. Swamps get little attention in terms of protection in spite of campaigns in support by WRUA team. Income generation projects that include Fruits like avocado and bee keeping are encouraged and supported." Ministry of Agriculture official added that*, "Piped water is treated and even the spring water too, because of the possible contamination making it unfit for domestic use.* From documents analysis, (photos): *Water harvesting at homes and institutions such as Tenwek Day Secondary School and eco-friendly actions under the green zone program,* are recorded. (1. WRUA Secretary)

4.6 Enabling Environment and Sustainability of Projects in Nyangores River Sub-Catchment Basin

The first objective of the study sought to establish the extent to which enabling environment influence sustainability of projects in Nyangores river sub-catchment basin in Bomet County, Kenya. The respondents were therefore asked to state their opinion by indicating the extent to which they agree or disagree with ten items derived from the indicators of this variable, and structured on a five point likert scale that runs from 1 to 5, in which: 1 represents Strongly disagree, 2 for Disagree, 3 for Neutral, 4 for Agree and 5 for Strongly agree. The results are shown in Table 4.6.

Table 4.6: Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin

Statements	SD	D	N	A	SA	Mean	SD
There is adequate financing for the management of projects in the basin	98	86	58	57	22	2.44	1.27
	30.5%	26.7%	18.1%	17.8%	6.9%		
No project or activity for water management purposes has ever stalled due to financial limitations.	98	82	61	55	25	2.46	1.29
	30.5%	25.5%	19.0%	17.2%	7.8%		
Some basin management projects have stalled due to financial limitation	53	69	54	80	65	3.11	1.38
	16.5%	21.6%	16.8%	24.9%	20.2%		
The sensitization meetings are popularly attended by the Basin community members.	91	99	65	52	14	2.37	1.17
	28.3%	30.8%	20.2%	16.3%	4.4%		
There are well planned sensitization meetings on the suitable practices of water management	81	141	33	49	17	2.31	1.16
	25.2%	43.9%	10.3%	15.3%	5.3%		
There are regular advocacy forum to address water issues	169	73	22	46	11	1.93	1.21
	52.6%	22.8%	6.9%	14.3%	3.4%		
Water management activities are usually guided by the given policy guidelines	75	83	40	95	28	2.74	1.33
	23.4%	25.9%	12.5%	29.5%	8.7%		
Water management policy document is easily available whenever you need it	96	90	61	53	21	2.42	1.25
	29.9%	28.0%	19.0%	16.6%	6.5%		
Politicians are rarely in support of the water resource management projects	30	60	35	131	65	3.44	1.26
	9.3%	18.7%	10.9%	40.9%	20.2%		
Most politicians are always willing and ready to support in water resource management	145	79	36	37	24	2.12	1.30
	45.2%	24.6%	11.2%	11.5%	7.5%		
Composite Mean and composite standard deviation						**2.53,**	**0.61**

Table 4.6 shows the respondents opinion on the ten statements in a likert scale were used. The results for item one, there is adequate financing for the management of projects in the basin area, out of 321 respondents, 98(30.5%) strongly disagree 86(26.8%) disagreed, 58(18.1%) were neutral, 57(17.8%) agreed and 22(6.9%) strongly agreed. The line item mean of 2.44 is less than the composite mean of 2.53, and SD of 1.28, greater than the composite standard deviation value of 0.61. This indicates that the financial position in the basin area does not

positively influence the sustenance of the projects. It implies that projects in the basin area require adequate financial support to remain sustained. The higher line item standard deviation of 1.28 than the composite standard deviation of 0.61 indicates that divergent opinions exist among the respondents.

The second item, no project or activity for water management purposes has ever stalled due to financial limitations, out of 321 respondents, 98(30.5%) strongly disagree with the item, no project or activity for water management purposes has ever stalled due to financial limitations, 82(25.5%) disagreed 61(19.0%) were neutral, 55(17.1%) agreed and 25(7.8%) strongly agreed. The item gave a line mean of 2.46 and SD of 1.29. The line item mean was below the composite mean value of 2.5343 suggest that to initiate and sustain projects for water management purposes, financial limitation have to be surmounted. The higher line item standard deviation of 1.29 than composite standard deviation of 0.61 indicates divergent views of the respondents.

Item third was; some basin management projects have stalled due to financial limitation, out of 321 respondents, 53(16.5%) strongly disagree 69(21.5%) disagreed 54(16.8%) were neutral, 80(24.9%) agreed and 64(20.2%) strongly agreed. While the composite values of mean and SD are 2.53 and 0.61 respectively, the line item mean was 3.11, well above the composite mean values of 2.53. This therefore, indicates that financial limitation is experienced and this has a negative influence on the sustenance of projects in the basin area. It suggests that there is need for adequate financing of the projects for sustainability. Further, this is in line with the findings of Makarius and Patrick, (2015), who noted that failure to declare revenue and financial expenditure on regular basis, as well as delays in submitting water use fees to Pangani Basin Water Organization, PBWO headquarters in Moshi compounded the problem, added that contradicting objectives of the WUA and lack of adequate funds, greatly contributed to the collapse of Mbukita WUA in PRB. The higher SD of 1.39, higher than the composite standard deviation of 0.61 indicates divergent opinions of the respondents

Fourth item, the sensitization meetings are popularly attended by the Basin community members, out of 321 respondents, 91(28.3%) strongly disagree 99(30.8%) disagreed 65(20.2%) were neutral, 52(16.2%) agreed and 14(4.4%) strongly agreed. The line item mean, in this case

was 2.37 and SD of 1.17. While the line mean is less than 2.53, the line SD is greater than the composite SD, 0.6039. The lower item mean indicate that sensitization meetings have not positively influence the sustenance of projects in the basin area, probably because they are not well attended by majority of the members. This agrees with, Makarius and Patrick, (2015), who found that Mbukita WUA, in Pangani river basin of Moshi, Tanzania, collapsed due to failure of leaders to convene regular meetings as dictated by the by-laws. It suggests that sensitization meetings by leaders, technocrats and chiefs *barazas* will provide forum for the dissemination of crucial information pertaining the sustenance of projects in the basin area. The higher line item standard deviation of 1.17, higher than the composite standard deviation of 0.61indicates divergent opinion among the respondents.

Item Five, there are well planned sensitization meetings on the suitable practices of water management, out of 321 respondents, 81(25.2%) strongly disagree 141(43.9%) disagreed 33(10.3%) were neutral, 49(15.3%) agreed and 17(5.3%) strongly agreed. The line item mean was 2.31, less than the composite mean value of 2.53 implied that sensitization meetings have not been adequately held and utilized in spite of the need to do so. Lack of sensitization meetings, therefore, have failed to positively influence the sustenance of projects as it ought to be. In a study, done by, Chumbulla and Ally, (2018), they found that, only 6.7% of the respondents were not aware of the by-laws and regulations, in Iringa District of Tanzania. This is a gap that the village and water committee leaders in the project areas would fill, if they play their roles of educating people accordingly on protecting their environment especially water source areas, in the basin area. The line item standard deviation of 1.161 is greater than 0.6039, which implied a divergence in the opinion of the respondents.

The sixth item, there are regular advocacy forum to address water issues, out of 321 respondents, 169(52.6%) strongly disagree 73(22.7%) disagreed 22(6.9%) were neutral, 46(14.3%) agreed and 11(3.4%) strongly agreed. The line item mean of 1.93 is far less than the composite mean value of 2.5343 and this implies that advocacy forum have not positively influenced the sustenance of projects in the basin area. Lack of advocacy forum; therefore, have failed to positively influence the sustenance of projects as it is the case with sensitization meetings in item five above. Chumbulla and Ally, (2018), found that, effective implementation

of the by-laws depends largely on users' knowledge about the laws and the associated penalties. The findings showed that advocacy forum would make the majority of community members aware and knowledgeable about the content of by-laws for environmental protection. The higher standard deviation of 1.215, than the composite standard deviation of 0.6039 indicates divergent opinions among the respondents.

The seventh item on the list was; water management activities are usually guided by the given policy guidelines, out of 321 respondents, 75(23.4%) strongly disagree 83(25.9%) disagreed 40(12.5%) were neutral, 95(29.6%) agreed and 28(8.7%) strongly agreed. The resulting line item mean was 2.74 greater than the composite line item mean of 2.53. Indicating that the given policy guidelines have positively influenced the sustenance of the projects in the basin area. However, the line item standard deviation of 1.33 greater than the composite standard deviation value of 0.61, indicate the divergent views of the respondents'. It suggests that the use of the appropriate policy guide is of great essence and therefore, once again, indicating the pivotal role of sensitization of the WRUA members and the other stakeholders alike, on the correct interpretation and implementation of the policy guideline. This supports the findings by Newig, (2010) who stated that the factors determining policy influence relate to procedures for policy development and formulation, substance of the policy itself, the resonance of new policy with existing standards of behavior and the costs of compliance and monitoring.

Eighth item in the line was; Water management policy document is easily available whenever you need it, out of 321 respondents, 96(29.9%) strongly disagree 90(28.0%) disagreed 61(19.0%) were neutral, 53(16.5%) agreed and 21(6.5%) strongly agreed. Compared to the composite mean value of 2.53 the line item mean of 2.42 is less, implying that the policy document has not, in practice, positively influenced the sustenance of the projects in the basin area. This agrees with Makarius and Patrick, (2015) who found in Pangani river basin that policy constrains, weaknesses in information dissemination, low capacity of the technical staff, further, undermined the water basin management and water governance in PRB. This demonstrates the complexity involved in policy guideline implementation. The policy document needs to be available whenever it is needed and its content correctly interpreted and implemented for it to have a positive contribution to the sustenance of the basin projects. On

the other hand, the line item standard deviation of 1.25 much higher than the composite standard deviation value of 0.61 represents the diverse opinions of the respondents.

The ninth item, politicians are rarely in support of the water resource management projects, out of 321 respondents, 30(9.3%) strongly disagree 60(18.7%) disagreed 35(10.9%) were neutral, 131(40.8%) agreed and 65(20,2%) strongly agreed. While the composite mean value was 2.53, the line item gave a score of 3.44 in this regard. This high score suggests that, indeed, the politicians are rarely in support of the water resource management projects, which has not positively influenced the sustenance projects in the basin area. The line item standard deviation of 1.26 much higher than the composite standard deviation of 0.61 represents the diverse opinions of the respondents.

The tenth item was; Most politicians are always willing and ready to support in water resource management, out of 321 respondents, 145(45.2%) strongly disagree 79(24.6%) disagreed 36(11.2%) were neutral, 37(11.5%) agreed and 24(7.5%) strongly agreed. These scores gave a line item mean of 2.21 far below the composite mean of 2.53. This situation indicates that politicians, in the basin area, have not positively supported the sustenance of the projects in the river basin. It means, if the local leaders, especially the politicians, commit themselves to support the efforts of the WRUA members, funding situation will improve, hence sensitization and acquisition of the necessary resources will improve, leading to greater sustenance of the projects within the basin area. This realization is in line with findings of, Tagseth, (2009), in Mbukita, Pangani, Tanzania, that lack of accountability among the staff and leadership, political interferences, theft of the collected funds, ineffective enforcement of the by-laws and inability to bring together all the stakeholders within the PRB, was rated as high among the challenges. The line item standard deviation of 1.30, much greater than the composite standard deviation of 0.6039 indicates divergent opinions of the respondents.

WRUA member who were interviewd had this to say;

> "*There is little political support, in spite of the constituency office located just next to the WRUA office, hence frequent request made for CDF offer, but we rely on well-wishers and a little of county government for financing. Politicians often duplicate the agencies for their own benefit. Sensitization was once done*

quite a while ago. There is no budgetary allocation for the same. There is sparse representation and we intend to have elaborate meetings to improve on this. There is a poor follow up to the projects implementation due to financial and human resource deficiency. We also use media broadcasting to reach our members such as "Sauti ya mazingira", in Bomet, to highlight on crucial environmental issues" (Source: 2. WRUA Committee)

The document analysis done revealed that there was*; Policy document filed, Sub-catchment management plan available and land use plan together with the minute books, Bank document and procurement documents.*

4.6.1 Correlation Analysis of Enabling Environment and Sustainabilty of Projects in Nyangores River Sub-catchment Basin

The correlation analysis was done using the Pearson Product Moment correlation to determine the relationship between the enabling environment and sustainability of projects in Nyangores river sub-catchment basin. The obtainable values in this correlation range from -1, (perfect negative correlation) to +1, (positive perfect correlation), and no correlation when the obtained value is 0.000. Otherwise, the correlation values, 0.001 to 0.250 indicate a weak correlation, 0.251 to 0.500 indicate a moderately strong correlation, 0.501 to 0.750, indicate a strong correlation and 0.751 to 1.000 indicate a very strong correlation. The results are as shown in Table 4.7.

Table 4.7: Correlation Analysis of Enabling Environment on Sustainability of Projects in Nyangores River Sub-catchment Basin

Variables		Enabling Environment	Sustainability of Projects
Enabling Environment	Pearson Correlation	1	0.491
	Sig. (2-tailed)		0.000
	n	321	321
Sustainability of Projects	Pearson Correlation	0.491	1
	Sig. (2-tailed)	0.000	
	n	321	321

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

Table 4.7 shows at 0.05 level of significance that there was a significant correlation between enabling environment and sustainability of projects, ($p < 0.05$). The correlation between the two variables was 0.491, which is moderately a strong correlation. This could be explained by the limited financial resources and insufficient sensitization to improve the enabling environment for the sustenance of projects. These results imply that there is a significant relationship between enabling environment and sustainability of projects in Nyangores river sub-catchment basin, leading to rejection of the null hypothesis 1.Ho: There is no significant relationship between enabling environment and sustainability of projects in Nyangores river Sub-catchment and acceptance of the alternative hypothesis and hence the study findings conclude that, there is a significant relationship between enabling environment and sustainability of projects in Nyangores river Sub-catchment basin. This conclusion agrees with Newig, (2010) who found that the factors determining policy influence relate to procedures for policy development and formulation, substance of the policy itself, the resonance of new policy with existing standards of behavior and the costs of compliance and monitoring, which comprise the enabling environment.

4.6.2 Regression Analysis between Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Simple linear regression was adopted to investigate how enabling environment influence sustainability of projects in Nyangores river sub-catchment basin. The rationale of using the simple regression model was to establish how enabling environment as a predictor significantly or insignificantly predicted the sustainability of projects in Nyangores river sub-catchment

basin. These are further explained in the subsequent themes: These are further discussed in the subsequent sub-themes:

4.6.2.1 Model Summary of Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin.

The model summary sought to establish how enabling environment as a predictor significantly or insignificantly predicted sustainability of projects in Nyangores river sub-catchment basin. The regression model summary is presented in Table 4.8.

Table 4.8: Model Summary of Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	Sig. F Change
1	0.491[a]	0.241	0.238	0.53883	0.000

The model summary results in Table 4.8 suggests that there is a positive correlation, (R= 0.491) between enabling environment and sustainability of projects in Nyangores river sub-catchment basin and those predicted by the regression model. Table 4.8 shows that R^2 is 0.241, this indicate how much variation in sustainability of projects is explained by enabling environment. Hence, 24.1% of changes in sustainability of projects is explained by enabling environment. It therefore means that if the WRUA members acted in a fully enabling environment, there will be a great improvement in the sustainability of projects. This agrees with the results of the discussion groups, in a study by, Tagseth, (2009), in Pangani Basin Water Organization, showed that Mbukita WUA collapsed due to failure of leaders to convene regular meetings as dictated by the by-laws and further, due to failure to declare revenue and financial expenditure on regular basis, as well as delays in submitting water use fees to Pangani Basin Water Organization, PBWO headquarters in Moshi, compounded the problem. It added that Mbukita WUA leaders tended to prioritize politicians and top civil servants during the water rationing, a form of corruption. These failures led to split of the WUA, resulting in the formation of new sub-canal leadership.

4.6.2.2 Analysis of Variance of Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin.

The analysis of variance was used to determine whether the model was a good fit for data analysis in the determination of the influence of enabling environment and sustainability of projects in nyangores river sub-catchment basin. The regression of ANOVA output statistics results are shown in Table 4.9

Table 4.9: ANOVA of Enabling Environment and Sustainability of Projects in Nyangores River Sub-catchment Basin

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	29.378	1	29.378	101.187	0.000[b]
	Residual	92.617	319	0.290		
	Total	121.995	320			

a. Dependent Variable: Sustainability of Projects
b. Predictors: (Constant), Enabling Environment

The ANOVA results from Table 4.9 shows that p=0.000<0.05, indicate that the model was a good fit in predicting the influence of enabling environment on sustainability of projects in Nyangores river sub-catchment basin. Hence the regression model results is significantly better prediction of sustainability of projects in Nyangores river sub-catchment basin.

4.6.2.3 Coefficients for Enabling Environment on Sustainability of Projects in Nyangores River sub-catchment Basin.

The study sought to establish whether there was influence of enabling environment on sustainability of projects in Nyangores river sub-catchment basin. The results of coefficient regression analysis are presented in Table 4.10.

Table 4.10: Coefficients of Enabling Environment on Sustainability of Projects in Nyangores River sub-catchment Basin.

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.631	0.130		12.553	0.000
	Enabling Environment	0.502	0.050	0.491	10.059	0.000

The simple linear regression coefficient results in Table 4.10 indicate that there was significant influence of enabling environment on sustainability of projects in Nyangores river sub-catchment basin. The coefficient of the constant term (βo = 1.631; $p<0.05$) and enabling environment, (β_1=0.502; $p< 0.05$) were statistically significant. The regression model for enabling environment was $y = 1.631+ 0.501X_1$.

Where: y = Sustainability of projects; X_1 = Enabling environment

4.7 Institutional Structures and Sustainability of Projects in Nyangores River Sub catchment Basin

The second objective of the study was to determine the extent to which institutional structures influence sustainability of Projects in Nyangores river sub-catchment basin in Bomet county, Kenya. The respondents were therefore asked to state their opinion by indicating the extent to which they agree or disagree with ten items derived from the indicators of this variable, and structured on a five point likert scale that runs from 1 to 5, in which: 1 represents Strongly disagree, 2 for Disagree, 3 for Neutral, 4 for Agree and 5 for Strongly agree. The results are shown in Table 4.11.

Table 4.11: Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Statements	SD	D	N	A	SA	Mean	SD
WRUA plays important role in water resource management.	64 19.9%	70 21.8%	49 15.3%	96 29.9%	42 13.1%	2.94	1.36
There is a clear order of steps or hierarchy of procedure when dealing with WRUA	72 22.4%	92 28.7%	64 19.9%	79 24.6%	14 4.4%	2.60	1.20
There is a great harmony among the various institutions concerned with the projects.	67 20.9%	88 27.4%	54 16.8%	98 30.5%	14 4.4%	2.70	1.23
There are many species of indigenous plants and animals.	63 19.6%	81 25.2%	62 19.3%	91 28.3%	24 7.6%	2.79	1.26
The trainings given have greatly improved the water management practices within the basin area	75 23.4%	81 25.3%	67 20.9%	73 22.6%	25 7.8%	2.66	1.27
Community member are regularly trained and sensitized on water resource management practices.	86 26.8%	89 27.7%	64 19.9%	60 18.7%	22 6.9%	2.51	1.26
WRUA Members are well trained on water resource management issues.	80 24.9%	91 28.4%	60 18.7%	71 22.1%	19 5.9%	2.56	1.24
Basin community members are happy with the hierarchy of WRUA structure.	78 24.3%	101 31.4%	51 15.9%	66 20.6%	25 7.8%	2.56	1.27
My sector representatives are actively involved in the River Basin programmes.	81 25.2%	120 37.4%	39 12.2%	56 17.4%	25 7.8%	2.45	1.25
My sector of the basin is fairly well represented in the WRUA consultations.	135 42.1%	86 26.8%	25 7.8%	55 17.1%	20 6.2%	2.19	1.31
Composite mean and Composite Standard Deviation						**2.60**	**0.93**

Table 4.11 show the frequencies of the likert scale responses for the ten items under the second variable; institutional structures. The first item under this variable; WRUA plays important role in water resource management, from 321 respondents, 64(19.9%) strongly disagree 70(21.8%) disagreed 49(15.3%) were neutral, 96(29.9%) agreed and 42(13.1%) strongly agreed. The line

item mean and SD, in this case, are 2.94 and 1.36, respectively. The higher line item mean of 2.94 than the composite mean of 2.60, imply that indeed WRUA plays an important role of positively influencing the sustainability of projects in the river basin. The WRUA need to be strengthened and more streamline to meet its intended objectives. This is in line with the findings by, Bandaragoda, (2000), on A framework for institutional analysis for water resources management in a river basin context, in Colombo, Sri Lanka, who noted that the physical and social diagnostic analyses helped in evaluating the existing institutional framework, as well as in formulating institutional change. The diagnostic analysis on performance of irrigated agriculture helped in the development and initiation of appropriate action plans to address the identified constraints against agricultural water management. The higher line item standard deviation of 1.36 than the composite standard deviation of 0.93 means there exists divergence view in the respondents.

The second item, there is a clear order of steps or hierarchy of procedure when dealing with WRUA, from 321 respondents 72 (22.4%) strongly disagree 92(28.7%) disagreed 64(19.9%) were neutral, 79(24.6%) agreed and 14(4.4%) strongly agreed. The line item mean was 2.60 same as the composite values. This indicates that, the clarity of order and procedures while dealing with WRUA has the potential of positively influencing the sustainability of projects in the basin area. This supports the findings of a study in Likii river basin, Kenya by Dell'Angelo, Paul, McCord, Drew, Stefan, Kelly, Caylor and Tom, (2015), which revealed that bottom-up representation is a critical feature of the Likii sub-catchment basin management, It involves a process by which the chair of every Community water partnership management committee would represent the Community water partnership in the WRUA management committee, forming the higher legislative body. This provides a procedure by which the people affected by the legislation can engage in establishing or adjusting them. This will make consultations and interaction among the members and with the leaders and experts, possible and fruitful. However, the higher line item standard deviation of 1.203 than the composite standard deviation of 0.9346 indicates divergence view on the respondents.

Item three, there is a great harmony among the various institutions concerned with the projects, from 321 respondents 67(20.9%) strongly disagree 88(27.4%) disagreed 54(16.8%) were

neutral, 98(30.5%) agreed and 14(4.4%) strongly agreed. The line item mean value of 2.70 is greater than the composite mean of 2.60 demonstrates that the harmony among the various institutions, WRUA, WRMA, Ministries of Water and Natural Resources and that of Agriculture, together with the County and National governments, have positively influenced sustenance of projects within the river basin. This concurs with Dell'Angelo, *et al,* (2015), that a management committee democratically elected makes decisions at the local level, and the chairs of these committees constitute the WRUA management committee, while the WRUA receives instructions from WRMA and the Ministry of Water and Irrigation. On the other hand, the higher line item standard deviation of 1.226 than the composite standard deviation of 0.9346 indicates there is still exist divergence views among the respondents.

Fourth item, there are many species of indigenous plants and animals, from 321 respondents 63(19.6%) strongly disagree 81(25.2%) disagreed 62(19.3%) were neutral, 91(28.3%) agreed and 24(7.5%) strongly agreed. Composite mean was 2.60; this is less than the line item value of 2.79. This shows that, in practice, the many species and indigenous plants and animals have been displaced, this signifies a degraded environment which compromises on the sustenance of projects in the basin area. It points out that the preservation of these species should not be left out if the projects must be sustained. However, the higher line item standard deviation of 1.257 than the composite standard deviation of 0.9346 indicates there is a divergence view of the respondents.

Fifth item, the trainings given have greatly improved the water management practices within the basin area, out of 321 respondents 75(23.4%) strongly disagree 81(25.2%) disagreed 67(20.9%) were neutral, 73(22.7%) agreed and 25(7.8%) strongly agreed. The line item mean of 2.66 is greater than the composite mean of 2.60, indicating that trainings given to the WRUA members have had a positive influence on the sustenance of projects in the basin area. This calls for more trainings to be provided to the basin community members. The lower composite SD of 0.9346 as compared to the line item value of 1.272 shows the divergence of views from the WRUA members.

The sixth item, Community member are regularly trained and sensitized on water resource management practices, out of 321 respondents 86(26.8%) strongly disagree 89(27.7%) disagreed 64(19.9%) were neutral, 60(18.7%) agreed and 22(6.9%) strongly agreed. In this case, the line item mean of 2.52 is lower than the composite mean of 2.60. An indication that training has not been sufficiently give to the community members and hence, it has not been optimized as a positive influencer to project sustenance. It is important to solicit the necessary assistance and forum to train the WRUA community members on the sustenance of projects in the basin area. However, the higher line item standard deviation of 1.272 than the composite standard deviation of 0.9346 indicates there is a divergence view of the respondents.

The seventh item, WRUA Members are well trained on water resource management issues. Out of 321 respondents 80(24.9%) strongly disagree 91(28.3%) disagreed 60(18.7%) were neutral, 71(22.1%) agreed and 19(5.9%) strongly agreed. The line item mean of 2.56 is slightly lower than the composite mean of 2.60. This imply that WRUA community members, if trained well, will be better placed to perform in line with greater sustenance of the projects within the basin area. Programs ought to be made, and appropriate resources put in place to ensure the members are trained on the sustenance of projects in Nyangores river basin, as stated, thus: Institutional roles involves creating organizational framework in various forms and functions, river basin and building institutional capacity by developing human resources, (IWRM, 2010). The higher line item standard deviation of 1.24 than the composite standard deviation of 0.9346 indicates there is a divergence view among the respondents.

The eighth item, Basin community members are happy with the hierarchy of WRUA structure, out of 321 respondents 78(24.3%) strongly disagree 101(31.5%) disagreed 51(15.9%) were neutral, 66(20.6%) agreed and 25(7.8%) strongly agreed. The composite mean of 2.60 is slightly higher and almost equal to the line item mean of 2.56. This implies that WRUA members, to some extent, appreciate the hierarchy of WRUA as a functional association, but a great potential remain untapped in this regard. However, the higher line item standard deviation of 1.271 than the composite standard deviation of 0.9346 indicates there is a divergence view of the respondents.

Ninth item, my sector representatives are actively involved in the River Basin programs, out of 321 respondents 81(25.2%) strongly disagree 120(37.4%) disagreed 39(12.1%) were neutral, 56(17.4%) agreed and 25(7.8%) strongly agreed. The line item mean was 2.45 below the composite value of 2.60. In this regard, if the sector representatives would be more actively involved in the basin programs, it will lead to higher sustenance of projects in the basin area. It therefore demands that the representatives need to be made more proactive and link up with the members more effectively for guidance and consultations. This agrees with the findings in a study by, Makarius and Patrick, (2015), who found that water User Association, (WUA), collapsed due to failure of the leaders to convene regular meetings, in Arusha, Tanzania. The composite SD was 0.93, much lower than the line item SD of 1.23 as a result of divergent views of the members on the aspect of representation.

The last item in this category, My sector of the basin is fairly well represented in the WRUA consultations, out of 321 respondents 135(42.1%) strongly disagree 86(26.8%) disagreed 25(7.8%) were neutral, 55(17.1%) agreed and 20(62. %) strongly agreed. The line item mean of 2.19 is much lower than the composite value of 2.60. This Indicates representation of the members and of the reality in the ground has not positively influenced the sustenance of projects in the basin area. It means that the real and tangible issues within the basin may not be adequately comprehended and addressed. It follows that representation is key and need to be refocused for better sustenance of the projects within the basin area, further, Dellapenna, (2013), found that bottom-up representation provides a procedure by which the people affected by the legislation can engage in establishing or adjusting them. On the other hand, the higher line item standard deviation of 1.31 than the composite standard deviation of 0.93 indicates a divergence of views among the respondents. This was in tandem with what the WRUA official shared through interview;

> "*We collaborate with various institutions; USAID, NEMA, WRMA, CAAC, LVBC, County and National governments. **W**RUA Structure has the management committee formed by the departmental executive members. There are three departments; Procurement, Finance and Monitoring together with Catchment Area Advisory Committee."* (Source: 1 WRUA Secretary)

4.7.1 Correlation Analysis Between Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin

The study sought to establish the correlation between institutional structures and sustainability of projects in Nyangores river basin. Pearson correlation coefficient was used to test the relationship between institutional structures and sustainability of projects in Nyangores river basin. The results are shown in Table 4.12.

Table 4.12: Correlations Results Between Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin

Variables		Sustainability of Project	Institutional Structures
Sustainability of Projects	Pearson Correlation	1	0.552
	Sig. (2-tailed)		0.000
	n	321	321
Institutional Structures	Pearson Correlation	0.552	1
	Sig. (2-tailed)	0.000	
	n	321	321

To test the extent of the relationship between institutional structures and sustainability of projects in Nyangores river sub-catchment basin, institutional structures was analyzed based on hypothesis, (2. H_0 : There is no significant relationship between institutional structures and sustainability of projects in Nyangores river sub-catchment basin). The corresponding mathematical model for the hypothesis was identified as: Sustainability of projects = f(Institutional structures).

The correlation results in Table 4.12, shows a correlation index between institutional structures and sustainability of projects in Nyangores river sub-catchment basin is, "r"= 0.552 and a propability value. P=0.000. This implies that there is a significant relationship between institutional structures and sustainability of projects in Nyangores river sub-catchment basin, leading to a rejection of the null hypothesis, (2. H_0 : There is no significant relationship between institutional structures and sustainability of projects in Nyangores river sub-catchment basin), and acceptance of the alternative hypothesis and hence the research findings conclude that there is a significant relationship between institutional structures and sustainability of projects in

Nyangores river sub-catchment basin. This concurs with the findings by, Bandaragoda, (2000), who concluded that the physical arrangement of the stream basin reflects the institutional game plans and further noted that the regular highlights of the basin, the qualities of framework, such as the size and scale, innovation, and reason will in general decide the sort and character of institutions set up for water resource control board.

4.7.2 Regression Analysis Between Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Regression analysis was adopted to enable investigate how institutional structures influence sustainability of projects in Nyangores river sub-catchment basin. The rational for using regression model was to determine how institutional structures as a predictor significantly or insignificantly predicted the sustainability of projects in Nyangores river sub-catchment basin. These are further discussed in the subsequent sub-themes:

4.7.2.1 Model Summary of Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin

The model summary sought to determine how institutional structures as a predictor significantly or insignificantly predicted the sustainability of projects in Nyangores river sub-catchment basin. The regression model summary is presented in Table 4.13

Table 4.13: Model Summary of Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin

	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig. F Change
1	0.552[a]	0.304	0.302	0.51583	0.000

The model summary in Table 4.13 shows that there is a positive correlation, (R= 0.552) between institutional structures and sustainability of projects in Nyangores river sub-catchment basin and those predicted by the regression model. R^2 =0.304, indicate the amount of variation in sustainability of projects that is explained by institutional structures. This implies that institutional structures explains 30.4% change in sustainability of projects in Nyangores river basin. institutional structures, therefore, if adequate investment is made, with all the aspects of

the resources, a great deal of improvement will be realized along the sustainability of projects in the basin area. The significance of institutional structures in river basin projects sustenance is further illustrated by, Dell'Angelo et al, (2015), who found that the process by which the chair of every Community water partnership management committee would represent the Community water partnership in the WRUA management committee, forming the higher legislative body, and the people affected by the legislation can engage in establishing or adjusting them. The study concluded that reflexive management is challenging, and the rate and magnitude of change calls for a deep and constant participation of the stakeholders and realignment of institutional approaches. Going forward, the study adds, water management in Mount Kenya will mostly relay on the way and extent of collaboration including sharing of information and on how adaptive to socio-environmental change the institutions are.

4.7.2.2 Analysis of Variance for Institutional Structures and Sustainability of Projects in Nyangores River Sub-Catchment Basin.

The Analysis of variance was used to establish whether the model was a good fit for the data in determining the influence of institutional structures on sustainability of projects in Nyangores river basin. The results are as shown in Table 4.14.

Table 4.14: ANOVA of Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.114	1	37.114	139.481	0.000[b]
	Residual	84.881	319	0.266		
	Total	121.995	320			

a. Dependent Variable: Sustainability of Projects
b. Predictors: (Constant), Institutional Structures

The ANOVA results in Table 4.14. Shows that the significance level, $p=0.000< 0.05$, the model was therefore a good fit in predicting the influence of institutional structures on sustainability of projects in Nyangores river basin. Therefore the regression model results is significantly better predictor of sustainability of projects in Nyangores river basin.

4.7.2.3 Coefficients of Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin.

The study sought to establish whether there was influence of institutional structures on sustainability of projects in Nyangores river basin. The results of coefficient analysis are presented in Table 4.15.

Table 4.15: Model Coefficient for Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	1.957	0.085		22.986	0.000
Institutional Structures	0.364	0.031	0.552	11.810	0.000

a. Dependent Variable: Sustainability of Projects

The simple linear regression coefficient results in Table 4.15 indicate that there was a significant influence of institutional structures on sustainability of projects in Nyangores river sub-catchment basin. The coefficient of the constant term, (β_0 =1.957, $p < 0.05$), and institutional structures (β_1 = 0.364; $p< 0.05$) were found to be statistically significant. Regression model for institutional structures was; $y=1.957+0.364X_2$

4.8 Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin.

The third objective of the study was, to examine the extent to which management instruments influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya. The respondents were therefore asked to state their opinion by indicating the extent to which they agree or disagree with ten items derived from the indicators of this variable, and structured on a five point likert scale in which; 1=Strongly Disagree, (SD), 2=Disagree, (D), 3=Neutral, (N), 4=Agree, (A) and 5=Stronglt Agree, (SA). The results are shown in Table 4.16.

Table 4.16: Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Statement	SD	D	N	A	SA	Mean	SD
	101	78	40	87	15		

There is financial incentive for those who preserve and manage water resource well.	31.5%	24.2%	12.5%	27.1%	4.7%	2.49	1.31
Water polluters are monitored and fined accordingly.	79	77	47	97	21	2.70	1.31
	24.6%	24.0%	14.7%	30.2%	6.5%		
Car washing is only done in designated points	80	84	41	91	25	2.68	1.33
	24.9%	26.2%	12.8%	28.3%	7.8%		
Complains on over charging for water use are common.	38	95	64	70	54	3.02	1.29
	11.8%	29.6%	19.9%	21.8%	16.9%		
Riparian management plan is well in place.	70	72	73	80	26	2.75	1.27
	21.8%	22.4%	22.8%	24.9%	8.1%		
Charges for water use are fair and affordable.	71	66	61	88	35	2.84	1.34
	22.1%	20.6%	19.0%	27.4%	10.9%		
The users effectively do payment for water use.	56	83	60	86	36	2.88	1.29
	17.4%	25.9%	18.7%	26.8%	11.2%		
The water resource management plan is very useful	54	71	56	90	50	3.03	1.34
	16.8%	22.1%	17.5%	28.0%	15.6%		
There is often financial limitations for the stated projects	43	92	43	92	51	3.05	1.32
	13.4%	28.7%	13.4%	28.7%	15.8%		
There is a clear water resource management plan in the basin area.	123	83	21	69	25	2.35	1.38
	38.3%	25.9%	6.5%	21.5%	7.8%		
Composite Mean and Composite Standard Deviation=						**2.7806**	**0.61212**

Item one, there is financial incentive for those who preserve and manage water resource well, out of 321 respondents, 101(31.5%) strongly disagree 78(24.3%) disagreed 40(12.5%) were neutral, 87(27.1%) agreed and 15(4.7%) strongly agreed. The line item mean was 2.49, and it is less than the composite mean of 2.7806. This indicates that incentives to the WRUA members, who do work to sustain the project has not been optimized to effectively influence the sustainability of projects within the basin area. It shows that the use of such incentives have

a great potential to positively influence sustainability of projects. This concurs with**,** (GWP, 2012)**,** Economic instruments involved the use of prices, subsidies, together with other market-based measures to provide incentives to all water users to use water carefully, efficiently and control pollution. However, the higher line item standard deviation of 1.31 than the composite standard deviation of 0.61212 indicates there is a divergence view of the respondents. Rockefeller Foundation, (2015), ascerts that, with traditional approaches of command and control in managing water having proven insufficient to address these challenges, new approaches by policy makers and water managers have to focus on incentive-based instruments to reduce pressure on water resources, while Atef, (2014), opines that the ideal management strategies are those that can effectively generate behavior change towards more efficient water use, stringent enough to encourage innovation, compatible with legal and institutional framework, stable enough to give security to investors, politically acceptable and implementable at a low monitoring and enforcement cost.

The second item was, Water polluters are monitored and fined accordingly, out of 321 respondents, 79(24.6%) strongly disagree 77(24.0%) disagreed 47(14.6%) were neutral, 97(30.2%) agreed and 21(6.5%) strongly agreed. The line item mean was 2.70, and it is slightly less than the composite mean of 2.7806. SD was 1.31, much greater than the composite SD of 0.6121 meaning there are divergent views among the respondents. When the water polluters are monitored and treated as the policy directs, sustainability of projects will be enhanced. The results suggest that this has not been adequately dealt with, in the basin area. This supports the findings in South Africa by, Melanie, Thandi and Rashid, (2015), who found that although the polluter-pays and user-pays principles have been approved, the manner of executing these remains a challenge. While the user-pays principle execution by basin organizations is still in the infancy stage, the tariff collection responsibility still rests within the central government.

Item three, Car washing is only done in designated points, out of 321 respondents, 80(24.9%) strongly disagree 84(26.2%) disagreed 41(12.8%) were neutral, 91(28.3%) agreed and 25(7.8%) strongly agreed. The line item mean was 2.68, and it is less than the composite mean of 2.7806. It indicates that car washing is not always done in the designated places, and this requirement should be enforced to minimize water resource and environmental pollutions. Car

washing in the rivers and on the road sides, is harmful to various species of plants and animals. The WRUA should consider identifying and constructing modern and suitably located car washing points to minimize the hazardous effects that come with uncontrolled washing points. The higher line item standard deviation of 1.33 than the composite standard deviation of 0.6121 indicates there is a divergence view of the respondents.

Item four, complains on overcharging for water use are common, out of 321 respondents, 38(11.8%) strongly disagree 95(29.6%) disagreed 64(19.9%) were neutral, 70(21.8%) agreed and 54(16.8%) strongly agreed. The line item mean was 3.02, and it is much higher than the composite mean of 2.7806. The results confirm that there are complains on over rating the charges for water use by the customers such as the institutions, industries and the business community. This could be explained by the faulty gauges, poor record keeping or corruption by the employees. This concurs with the findings of, Nyika, Karuku and Onwonga, (2017) which found that corruption and bribery cases have deterred water payment by users without redress. The findings, further, revealed that metered water users were higher (mean=53.5, 30%) compared to paying users (mean=19.75, 11%) across the study area and the two groups were statistically significant ($p \leq 0.05$). Divergent views of the respondents were indicated by the higher line item standard deviation of 1.29 relative to the composite standard deviation of 0.6121.

Item five, Riparian management plan is well in place, out of 321 respondents, 70(21.8%) strongly disagree 72(22.4%) disagreed 73(22.7%) were neutral, 80(24.9%) agreed and 26(8.1%) strongly agreed. The line item mean was 2.75, and it is less than the composite mean of 2.7806, the lower item mean shows that riparian management plan is yet to be readily availed to the riparian members. It indicates that to improve on projects sustenance, the management plan ought to be made, updated appropriately and operationalized effectively. The views were divergent, nonetheless, as implied by the line item SD of 1.27, much greater than the composite SD of 0.6121. Mazlin, (2009), concluded that in order to improve the water supply and sewerage services and for better control, the Federal Government had to amend the Water Services Industry Act 2007, which shifted water supply and sewerage services from the State list to the Federal list. Although there is an existing comprehensive legislation framework in

Malaysia, it is still lack of provision such as Water Resources Management Enactment in the State level to recognise the roles of local communities into water resources planning and management in Pahang State.

Item six, Charges for water use are fair and affordable, out of 321 respondents, 71(22.1%) strongly disagree 66(20.6%) disagreed 61(19.0%) were neutral, 88(27.4%) agreed and 35(10.9%) strongly agreed. The line item mean was 2.84, and it is greater than the composite mean of 2.7806, it suggests that the fair and affordable price of water has positively influenced the sustainability of projects in the basin area. It generates more income enabling the sustenance of projects within the basin area. This is in line with, Neil and Ross, (2018), who pointed out that the main function is to encourage economic agents, change their behavior, to contribute to sound water resources management, conservation and protection as well as tools to generate revenue to finance water management or provide water-related services. The higher line item standard deviation of 1.34 than the composite standard deviation of 0.6121 means there exists divergence view in the respondents

The seventh item was, the users effectively do payment for water use, out of 321 respondents, 56(17.4%) strongly disagree 83(25.9%) disagreed 60(18.7%) were neutral, 86(26.8%) agreed and 36(11.2%) strongly agreed. The line item mean was 2.88, and it is higher than the composite mean of 2.7806. The water payment by those who use it has been effectively done and has positively influenced the sustainability of projects within the basin area. This is a source of income that supports the activities that sustain the projects in the basin area. However, the higher line item standard deviation of 1.29 than the composite standard deviation of 0.6121 means divergent views among the respondents exists.

Item eighth was, the water resource management plan is very useful, out of 321 respondents, 54(16.8%) strongly disagree 71(22.1%) disagreed 56(17.4%) were neutral, 90(28.0%) agreed and 50(15.6%) strongly agreed. The line item mean was 3.03, and it is greater than the composite mean of 2.7806. It suggests that the management plan use has positively contributed to the sustenance of projects in the basin area. The WRUA members appreciate the management plan and its usefulness. It means they are ready and willing to use it towards the sustenance of

their projects. This fails to agree with a study in S. Africa and Swaziland done by, Melanie, Thandi and Rashid, (2015), who found that the pilot testing of the instruments in the IRB failed to provide insights into water resource evaluation, plans, demand control and regulatory tools in the basin. The analysis suggested a consideration of phased approach to evaluation of IWRM, since its execution seem to follow a systematic process that starts from creating the enabling environment, before the formation and execution of the institutional framework and ultimately the formation and use of integrated water asset control management instruments. The higher line item standard deviation of 1.34 than the composite standard deviation of 0.6121 means there were divergent opinion among the respondents

Item nine was; there is often financial limitations for the stated projects, out of 321 respondents, 43(13.4%) strongly disagree 92(28.7%) disagreed 42(13.1%) were neutral, 92(28.7%) agreed and 51(15.9%) strongly agreed. The line item mean was 3.05, and it is much higher than the composite mean of 2.7806, SD was 1.32, again much greater than the composite SD of 0.6121. The statistics confirm that financial limitation for the stated projects is often experienced in the basin area. It implies that the community members must address the financial challenge and ensure it is reasonably met. The high SD on line item again shows that opinions gathered were divergent.

The final item in this category was; There is a clear water resource management plan in the basin area, out of 321 respondents, 123(38.3%) strongly disagree 83(25.9%) disagreed 21(6.5%) were neutral, 69(21.5%) agreed and 25(7.8%) strongly agreed. The line item mean was 2.35, less than the composite mean of 2.7806; This suggest that a clear and workable water resource management plan need to be put in place, by the concerned, and WRUA members empowered with necessary skills and knowhow to be able to work as per the given plan. The line item SD was 1.38, greater than the composite value of 0.6121 and indicates diverging opinions of the respondents. WRUA officials interviewed had this to say;

> "*Policy is little known, neither is it in use. Piped water is paid for by the consumers. It was initially managed by the community but now done by the county government. The county government raised the water prices for the consumers while the control of polluters is hampered by lack of infrastructure.*

Car washing is more often done in wrong points such in the river sides, however, some self- help groups own car washing points and these groups have been sensitized on pollution control and detriments of drug abuse. Where bill boards are raised against activities such as anti-carwash, some cruel people remove or change the writings. WRUA gets no income from water sales or water services. One water sale point was once in Siongiroi market but it collapsed due to mismanagement. Documents from county water Director revealed, "*Feasibility study done and documented, with detailed design and preparation of tender documents while Policy documents are available in the office"* (Source 3; County Water Director).

4.8.1 Correlation Analysis of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin

The study sought to establish the correlation between Management Instruments and sustainability of projects in Nyangores river basin. Pearson correlation coefficient was used to test the relationship between management instruments and sustainability of projects in Nyangores river basin. The results are shown in Table 4.17.

Table 4.17: Correlations Results Between Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin

Variable		Sustainability of Projects	Management Instruments
Sustainability of Projects	Pearson Correlation	1	0.561
	Sig. (2-tailed)		0.000
	n	321	321
Management Instruments	Pearson Correlation	0.561	1
	Sig. (2-tailed)	0.000	
	n	321	321

To test the relationship between Management Instruments and sustainability of projects in Nyangores river sub-catchment basin, Management Instruments were analyzed based on hypothesis (3. $H_{0;}$ There is no significant relationship between management instruments and sustainability of Projects in Nyangores river Sub-catchment basin). The corresponding mathematical model for the hypothesis was; Sustainability = f (Management Instruments). The correlation results are presented in Table 4.17. It shows a correlation index between management instruments and sustainability of Projects in Nyangores river Sub-catchment basin, ("r"= 0.561), a strong positive correlation with ($p = 0.000 < 0.05$). This implies that there is a significant relationship between management instruments and sustainability of Projects in Nyangores river Sub-catchment Basin, leading to rejection of the null hypothesis, (3. $H_{0;}$ There is no significant relationship between management instruments and sustainability of Projects in Nyangores river Sub-catchment basin), and acceptance of the alternative hypothesis and hence the study concluded that there is a significant relationship between management instruments and sustainability of Projects in Nyangores river Sub-catchment basin.

4.8.2 Regression Analysis Between Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Regression analysis was adapted to enable investigate how management instruments influence sustainability of projects in Nyangores river sub-catchment basin. The rationale for using regression model was to establish how management instruments as a predictor significantly or insignificantly predicted the sustainability of projects in Nyangores river sub-catchment basin. These are further discussed as follows:

4.8.2.1 Model Summary of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin.

The model summary sought to establish how management instruments as a predictor significantly or insignificantly predicted the sustainability of projects in Nyangores river sub-catchment basin. The regression model summary is presented in Table 4.18

Table 4.18: Model Summary of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.561[a]	0.314	0.312	0.51208

The model summary in Table 4.18 shows that there is a positive correlation, (R= 0.561) between management instruments and sustainability of projects in Nyangores river sub-catchment basin and those predicted by the regression model. (R^2 =0.314), indicate the amount of variation in sustainability of projects that is explained by Management Instruments. These findings are consistent with previous studies which posited that regulatory instruments are critical for the execution of water resource policies and legislative peremptory that creates operational guide, (GWP, 2006), It further added that economic instruments involved the use of prices, subsidies, together with other market-based measures to provide incentives to all water users to use water carefully, efficiently and control pollution. On the other hand, Tirole and Laffont, (1991), confirm that managing water at the basin level, requires assigning economic instruments to a well-defined roles within the relevant policy outline, so as to achieve the greatest collective benefit in line with the fundamental social- and political-welfare concerns, further affirming the critical relation of management instrument and sustenance of resources for optimum collective benefits.

4.8.2.2 ANOVA of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin.

The Analysis of variance was used to establish whether the model was a good fit for the data in determining the influence of Management Instruments on sustainability of projects in Nyangores river basin. The results are shown on Table 4.19.

Table 4.19: ANOVA of Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.344	1	38.344	146.226	0.000[b]
	Residual	83.650	319	0.262		
	Total	121.995	320			

a. Dependent Variable: SP

b. Predictors: (Constant), MI

The ANOVA results in Table 4.19 shows that the significance level was, p=0.000< 0.05, the model was therefore a good fit in predicting the influence of Management Instruments on sustainability of projects in Nyangores river basin. The regression model results is therefore better prediction of sustainability of projects in Nyangores river basin.

4.8.2.3 Regression Coefficients of Management Instruments and Sustainability of Projects in Nyangores river basin.

The study sought to establish whether there was influence of management instruments on sustainability of projects in Nyangores river basin. The results of regression coefficient analysis are presented in Table 4.20.

Table 4.20: Model Coefficients for Management Instruments and Sustainability of Projects in Nyangores river basin.

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.330	0.133		9.990	0.000
	Management Instruments	0.566	0.047	0.561	12.092	0.000

The simple linear regression coefficient results in Table 4.20 indicated that there was a significant influence of management instruments on sustainability of River sub-catchment basin. The coefficient of the constant term, (β_0 =1.330, p < 0.05), and management instruments (β_3 = 0.566; p< 0.05) were found to be statistically significant. Regression model for management instruments was; y=1.330+0.566X_3.

4.9. Infrastructure Development and Sustainability of Projects in Nyangores river basin.

The fourth objective sought by the study was to establish the extent to which infrastructure development influence sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya. The respondents were therefore asked to state their opinion by indicating the extent to which they agree or disagree with the ten items derived from the indicators of this variable, and structured on a five point likert scale in which; 1=Strongly Disagree, (SD), 2=Disagree, (D), 3=Neutral, (N), 4=Agree, (A) and 5=Stronglt Agree, (SA). The results are shown in Table 4.21.

Table 4.21: Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Statements	SD	D	N	A	SA	Mean	SD
The dumping sites are regularly in use by the family members	49	72	40	113	47	3.18	1.73
	15.3%	22.4%	12.5%	35.2%	14.6%		
Most homes have a well-designated dumping site.	50	72	53	117	29	3.01	1.26
	15.6%	22.4%	16.5%	36.5%	9.0%		
Rainwater storage facilities are common in homes/families.	49	56	37	125	54	3.25	1.34
	15.3%	17.4%	11.6%	38.9%	16.8%		
Swampy areas are purposely protected to conserve water	73	80	41	97	30	2.79	1.34
	22.7%	24.9%	12.9%	30.2%	9.3%		
There is known number of waste water treatment plants	72	74	59	93	23	2.75	1.28
	22.4%	23.1%	18.3%	29.0%	7.2%		
Pans and ponds are regularly maintained	63	81	64	82	31	2.80	1.28
	19.6%	25.2%	19.9%	25.5%	9.8%		
Sloppy areas in the farm are covered by vegetation throughout the year.	45	83	56	99	38	3.01	1.27
	14.1%	25.9%	17.4%	30.8%	11.8%		
Water ways are well designed to control run-off	51	71	43	112	44	3.08	1.32
	15.9%	22.1%	13.4%	34.9%	13.7%		
Ploughing is always done across the slope to retain the rain water	39	68	39	126	49	3.24	1.28
	12.1%	21.2%	12.1%	39.3%	15.3%		
Sloppy parts of the farms are fairly modified by terracing to control erosion	73	71	35	111	31	2.86	1.36
	22.7%	22.1%	10.9%	34.6%	9.7%		
Composite Mean and Composite SD =						**2.99 8**	**0.92882**

Item one, the dumping sites are regularly in use by the family members, out of 321 respondents, 48(15.0%) strongly disagree 72(22.4%) disagreed 40(12.5%) were neutral, 113(35.2%) agreed and 47(14.6%) strongly agreed. The line item mean was 3.18, greater than the composite value was 2.99. This shows that the regular use of damping in families has greatly improved the sustainability of projects in the basin area. This reduce the litter and environmental pollution, hence the rivers and the waters around and the forest and the surroundings remain healthy and habitable. However, the higher line item standard deviation of 1.73 than the composite standard deviation of 0.9288 means divergent views among the respondents exists.

Item two, most homes have a well-designated dumping site, out of 321 respondents, 50(15.6%) strongly disagree 72(22.4%) disagreed 53(16.5%) were neutral, 117(36.4%) agreed and 29(9.0%) strongly agreed. The line item mean was 3.01, greater than the composite value was 2.9978. The higher line item mean indicates that the proper and clarity of the dumping sites at homes, within the basin area have positively influenced the sustainability of projects. It confirms the importance of the domestic as well as the public dumping sites**.** The higher line item standard deviation of 1.26 than the composite standard deviation of 0.9288 means there was divergent opinions among the respondents.

Item three, rainwater storage facilities are common in homes/families, out of 321 respondents, 49(15.3%) strongly disagree 56(17.4%) disagreed 37(11.5%) were neutral, 125(38.9%) agreed and 54(16.8%) strongly agreed. The line item mean was 3.25, greater than the composite value was 2.9978. The domestic rain harvesting has provided a rich source of water for domestic utility, improving the situation of water supply and simultaneously reduce water run-off, during and after the rain, which, ultimately reduce soil erosion, reduce river siltation and water pollution. Higher line item standard deviation of 1.339 than the composite standard deviation of 0.9288 indicates divergent views among the respondents.

The fourth item was; Swampy areas are purposely protected to conserve water, out of 321 respondents, 73(22.7%) strongly disagree 80(24.9%) disagreed 41(12.8%) were neutral, 96(30.2%) agreed and 30(9.3%) strongly agreed. The line item mean was 2.79, less than the composite value was 2.9978. It suggests that the swampy areas, given appropriate attention,

vegetation cover, left uncultivated, growing environmentally friendly species of trees such as the indigenous options, would improve agroforestry and water supply which is the sustenance of the projects within the basin area. High SD is a show of divergent views. However, the higher line item standard deviation of 1.34 than the composite standard deviation of 0.9288 represented divergent views of the respondents.

Item five, there is known number of waste water treatment plants, out of 321 respondents, 72(22.4%) strongly disagree 74(23.1%) disagreed 59(18.4%) were neutral, 93(29.0%) agreed and 23(7.2%) strongly agreed. The line item mean was 2.75, lower than the composite mean value of 2.9978. This statistic imply that the waste water treatment points have not influenced project sustenance positively in the basin area. It shows that these plants are inadequate and little known to the WRUA community members, while on the other hand, the higher line item SD of 1.28 relative to the composite SD of 0.9288 imply that there were varied opinions among the respondents.

Item six was; Pans and ponds are regularly maintained, out of 321 respondents, 63(19.6%) strongly disagree 81(25.2%) disagreed 64(19.9%) were neutral, 82(25.5%) agreed and 31(9.7%) strongly agreed. The line item mean was 2.80, lower than the composite mean of 2.9978. Where found, pans and ponds have not had an optimum impact towards the sustenance of projects, since they are not well maintained. To raise the projects sustenance, these infrastructures should be properly di-silted and maintained to facilitate fish farming and boost the water supply as well as retaining the excess run-off from the rains. In this way, sustenance of projects would be realized. The line item SD of 1.28 higher than the composite SD of 0.9288 shows that respondents had varied views. Yericho, Berhanu and Meshesha, (2019), found that, the dams served as a spot for fishing, at which the local community did fishing for food and income generation in Omo-Gibe basin, Ethiopia.

Item seven, Sloppy areas in the farm are covered by vegetation throughout the year, out of 321 respondents, 45(14.0%) strongly disagree 83(25.9%) disagreed 56(17.4%) were neutral, 99(30.8%) agreed and 38(11.8%) strongly agreed. The line item mean was 3.01, greater than the composite mean was 2.9978. The vegetation that grows in sloppy parts of the farm, provide

soil cover and maintain the soil fertility and hence, productivity. This sustains the farm projects as well as the rivers and the source of water resource. WRUA members need to ensure that practice growing the most suitable crop cover is up held. The line item SD was1.27 higher than the composite SD of 0.9288 since the respondents had divergent opinions.

Item eight, Water ways are well designed to control run-off, out of 321 respondents, 51(15.9%) strongly disagree 71(22.1%) disagreed 43(13.4%) were neutral, 112(34.9%) agreed and 44(13.7%) strongly agreed. The line item mean was 3.08, greater than the composite mean value of 2.9978. This is to imply that the presence and the appropriate design of the water ways and diversions have contributed positively to the sustenance of projects in the basin area. This is an effective way of flood control and even possible siltation in the farms which may burry the crops and livestock. However, the higher line item SD of 1.32, than the composite SD of 0.9288 indicate divergent views among the respondents.

Item nine was; Ploughing is always done across the slope to retain the rain water, out of 321 respondents, 39(12.1%) strongly disagree 68(21.2%) disagreed 39(12.1%) were neutral, 126(39.3%) agreed and 49(15.3%) strongly agreed. The line item mean was 3.24, greater than the composite mean value was 2.9978; this is to imply that the ploughing along the contour has positively influenced sustainability of projects in Nyangores river basin. This, further reduce the contamination of the waters and all that is in there. The line item SD of 1.28 was higher than the composite SD of 0.9288 since the respondents had divergent opinions.

Tenth item was; Sloppy parts of the farms are fairly modified by terracing to control erosion, out of 321 respondents, 73(22.7%) strongly disagree 71(22.1%) disagreed 35(10.9%) were neutral, 111(34.6%) agreed and 31(9.7%) strongly agreed. The line item mean was 2.86, less than the composite mean of 2.9978. This indicated that the use of terracing as a technique of soil erosion control has not been effectively utilized. It suggest that the WRUA members have to find out the hindrances in the use of this recommended technique, and overcome them to improve on the sustainability of projects within the basin area. This in concurrence with, Halla, (2017), assertion that, the development of quantitative frameworks for assessing the long-term sustainability of infrastructure relating to, on one hand, decision-making, investment planning,

and asset management, and on the other, environmental factors such as, energy usage, materials inflows, residuals, and ultimately, an efficient service provision to maintain and enhance quality of life, is the main objective. However, line item SD of 1.36, higher than the composite SD of 0.9288, shows that there was divergent views among the respondent. WRMA official who were interviewed had this to say;

> "*The infrastructure is very limited and also quite old, this is a great limitation to pollution control. Office equipment; furniture, Computers lacking or inadequate. The Ponds and pans suffer from poor maintenance, siltation, unsuitable trees grown around them and lack fencing for protection. There are 40 shallow pans in Itembe but heavily silted. Always, the cost is inflated for selfish gains, whenever funds are availed for these constructions. Lagoons that exist suffer poor maintenance and rampant seepage. Planning and design for infrastructure development has been done. De-siltation of water pans and drilling bore holes, are done although lack of finance is often a limitation. Some challenges include; Stalled Bosta water project and lack of license from NEMA. Poor design of road run-off and over flowing pit latrines. There is lack of site for solid waste, only one dumping site in Bomet exists. Waste treatment plant in Bomet and various septic tanks and exhausters available, and owned by Bomet Water Company. Detailed design already in place for Sotik sewerage system, at a cost of ksh 600 million. Water harvesting infrastructure is common such as one in Tenwek Day Secondary School" (*Source 4: Water Officer, Bomet)

4.9.1 Correlation Between Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin

The study sought to establish the correlation between infrastructure development and Sustainability of Projects in Nyangores River Sub-catchment Basin. Pearson Product Moment correlation was used to determine the correlation between infrastructure development and sustainability of projects in Nyangores river sub-catchment basin. The values of the correlation, "r" range from -1, (perfect negative correlation) to +1, (positive perfect correlation), and no correlation when the obtained value is 0.000. Otherwise, the correlation values, 0.001 to 0.250 indicate a weak correlation, 0.251 to 0.500 indicate a moderately strong correlation, 0.501 to

0.750, indicate a strong correlation and 0.751 to 1.000 indicate a very strong correlation. The results are shown in Table 4.22.

Table 4.22: Correlation Between Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin

		Sustainability of Projects	Infrastructure Development
Sustainability of Projects	Pearson Correlation	1	0.514
	Sig. (2-tailed)		0.000
	n	321	321
Infrastructure Development	Pearson Correlation	0.514	1
	Sig. (2-tailed)	0.000	
	n	321	321

To test the relationship between infrastructure development and sustainability of projects in Nyangores river sub-catchment basin, infrastructure development was analyzed based on hypothesis (4. $H_{0;}$ There is no significant relationship between infrastructure development and sustainability of Projects in Nyangores river Sub-catchment basin). The corresponding mathematical model for the hypothesis was; Sustainability = f (infrastructure development). The correlation results are presented in Table 4.22.

As shown in Table 4.22, "r"=0.514, a strong positive correlation between infrastructure development and sustainability of projects in Nyangores river sub-catchment basin. The p-value, 0.000< 0.05 indicate that this positive strong correlation is significant. This implies that there is a significant relationship between infrastructure development and sustainability of projects in Nyangores river sub-catchment basin, leading to a rejection of the null hypothesis, (4. H_0: There is no significant relationship between infrastructure development and sustainability of projects in Nyangores river sub-catchment basin), and acceptance of the alternative hypothesis and hence the study conclude that there is a significant relationship between infrastructure development and sustainability of projects in Nyangores river sub-catchment basin.

4.9.2 Regression Analysis Between Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Regression analysis was adapted to enable investigate how infrastructure development influence sustainability of projects in Nyangores river sub-catchment basin. The reason for using regression model was to establish how infrastructure development as a predictor significantly or insignificantly predicted the sustainability of projects in Nyangores river sub-catchment basin. These are further discussed in the subsequent sub-themes:

4.9.2.1 Model Summary of Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin

The model summary sought to determine how infrastructure development as a predictor significantly or insignificantly predicted the sustainability of projects in Nyangores river sub-catchment basin. The regression model summary is presented in Table 4.23

Table 4.23: Model Summary of Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig
1	0.514[a]	0.264	0.262	0.53036	0.000

The model summary in Table 4.23 shows that there is a positive correlation, (R= 0.514) between infrastructure development and sustainability of projects in Nyangores river sub-catchment basin and those predicted by the regression model. R^2 =0.264, indicate the amount of variation in sustainability of projects that is explained by infrastructure development. This implies that infrastructure development explains 26.4% change in sustainability of projects in Nyangores river basin, therefore, if adequate investment is made, in the infrastructure such as pan, bonds and dumping sites, better improvement will be realized along the sustainability of projects in the basin area.

4.9.2.2 Analysis of Variance of and Infrastructure Development Sustainability of Projects in Nyangores River Sub-Catchment Basin.

The Analysis of variance was used to establish whether the model was a good fit for the data in determining the influence of infrastructure development on sustainability of projects in Nyangores river basin. The results are as shown in Table 4.24

Table 4.24: ANOVA for Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	32.266	1	32.266	114.712	0.000[b]
	Residual	89.728	319	0.281		
	Total	121.995	320			

a. Dependent Variable: Sustainability of Projects
b. Predictors: (Constant), Infrastructure Development

The ANOVA results in Table 4.24 shows that, the significance level, p=0.000< 0.05, the model was therefore a good fit in predicting the influence of infrastructure development on sustainability of projects in Nyangores river basin. The regression model is therefore significantly better prediction of sustainability of projects in Nyangores river basin.

4.9.2.3 Coefficients of Infrastructure Development and Sustainability of Projects in Nyangores River Sub-Catchment Basin

The study sought to establish whether there was influence of infrastructure development on sustainability of projects in Nyangores river sub-catchment basin. The results of regression coefficient analysis are presented in Table 4.25.

Table 4.25: Model Coefficients of Infrastructure Development and Sustainability of Projects in Nyangores River Sub-Catchment Basin.

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.878	0.100		18.745	0.000
	Infrastructure Development	0.342	0.032	0.514	10.710	0.000

The simple linear regression coefficient results in Table 4.25 indicate that there was a significant influence of infrastructure development on sustainability of River sub-catchment basin. The coefficient of the constant term, (B_0 =1.878, $p < 0.05$), and institutional structures ($\beta 4 = 0.342$; $p< 0.05$) were found to be statistically significant. Regression model for infrastructure development was; $y= 1.878+0.342X_4$. This indicates that for each unit of infrastructure development, sustainability of projects in Nyangores is marginally transformed by 0.342 units. Table 2.25 shows that infrastructure development has a positive significant influence on sustainability of projects indicated by the regression coefficient 0.342 and a p-value 0.000. The results suggest that infrastructure development play a critical role, and therefore every effort should be made to strengthen them for projects sustenance in the basin area.

4.10 Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin

The fifth objective of the study was; to determine the combined influence of Water Resource Management Tools on Sustainability of Projects. The combined variable is formed by the sum of the means of the line items, then divide by the number of the independent variables, in this case, four; Infrastructure Development, Enabling Environment, Management Instruments and Institutional Structures. The results are presented in Table 4.26.

Table 4.26: Combined Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin

Variables	Composite Mean	Composite Standard Deviation
Enabling Environment	2.5343	0.6039
Institutional Structures	2.5963	0.9346
Management Instruments	2.7806	0.6121
Infrastructure Development	2.9978	0.9287
Composite Mean and Standard Deviation	**2.7273**	**0.7698**

Table 4.26 shows the results of the combined water resource management tools and sustainability of projects in Nyangores river sub-catchment basin. The first variable, enabling environment had a line mean of 2.5343 less than the composite mean of 2.7273. This implies that enabling environment as a water resource management tool, has relatively less influence on the sustainability of projects in Nyangores river sub-catchment basin. Variable two, institutional structures gave a line mean of 2.5963, again less than the composite mean of 2.7273, which indicate a relatively less influence on the sustainability of projects the basin area. The third variable, management instruments had a line mean of 2.7807, greater than the composite mean of 2.7273, hence relatively greater influence on sustainability of projects in the basin area. Fourth variable, infrastructure development, had the highest line mean of 2.9978, greater than the composite mean of 2.7273. It implies that infrastructure development had the leading influence, among the studied variables, on sustainability of projects in Nyangores river sub-catchment basin.

4.10.1 Correlations Analysis of Combined Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment basin

Inferential statistics was conducted on study participants perspectives on the relationship between combined water resource management tools and sustainability of projects in Nyangores river sub-catchment basin. Pearson correlation coefficient was used to test the relationship at 95% level of confidence. The correlation results are presented in Table 4.27.

Table 4.27: Correlations Results between Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment basin

Variables		Sustainability of Projects	Combined Variable
Sustainability of Projects.	Pearson Correlation	1	0.648
	Sig. (2-tailed)		0.000
	n	321	321
Water Resource Management Tools	Pearson Correlation	0.648	1
	Sig. (2-tailed)	0.000	
	n	321	321

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

The correlation coefficient for combined water resource management tools on sustainability of projects in Nyangores river sub-catchment basin, was found to be 0.648 with a p-value of 0.000 $< \alpha = 0.05$ implying that there is a significant relationship between combined water resource management tools and sustainability of projects in Nyangores river sub-catchment basin, leading to rejection of the null hypothesis (5. $H_{0:}$ There is no significant relationship between combined water resource management tools and sustainability of projects in Nyangores river sub-catchment basin) and acceptance of alternative hypothesis and hence, the research finding concluded that there is significant relationship between combined water resource management tools and sustainability of projects in Nyangores river sub-catchment basin.

4.10.2 Regression Analysis of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin

Multiple linear regression analysis was adopted to investigate the influence of combined water resource management tools on sustainability of projects in Nyangores river sub-catchment basin. These are further discussed in the sub-themes as follows:

4.10.2.1 Model Summary of Combined Influence of Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin

The model summary sought to establish how combined water resource management tools, as a predictor, significantly or insignificantly predicted sustainability of projects. The model summary results are presented in Table 4.28.

Table 4.28: Model Summary of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig.
1	0.648[a]	0.420	0.418	0.47093	0.000

a. Predictors: (Constant), Combined Variable

Model summary results in Table 4.28 show that there is a positive strong correlation between combined water resource management tools and sustainability of projects in Nyangores river sub-catchment basin. In Table 4.28, R^2 was used to show the variation in the dependent variable, (sustainability of projects), that could be explained by the combined independent variables; enabling environment, institutional structures, management instruments and infrastructure development. R^2 =0.420, which implies that the combined water resource management tools, explained 42.0% of the variation in the dependent variable, which is sustainability of projects.

4.10.2.2 ANOVA of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin.

The analysis of variance was used to establish whether the model was good fit for the data in determining the influence of combined water resource management tools on sustainability of projects in Nyangores river sub-catchment basin. The results are shown in Table 4.29.

Table 4.29: ANOVA of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.250	1	51.250	231.094	0.000[b]
	Residual	70.745	319	0.222		
	Total	121.995	320			

a. Dependent Variable: Sustainability of Projects
b. Predictors: (Constant), Combined Variable

Table 4.29, indicate that the model was fit in determining the influence of combined independent variables, (Infrastructure Development, Enabling Environment, Management Instruments and Institutional Structures), on Sustainability of Projects, since, P=0.000< 0.05.

The regression model results were significantly a better prediction of sustainability of projects in Nyangores river sub-catchment basin.

4.10.2.3 Coefficient of Combined Influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-Catchment Basin

The study sought to establish whether there was influence of combined water resource management tools on sustainability of projects in Nyangores river sub-catchment basin on sustainability of projects in Nyangores river sub-catchment basin. The results of regression coefficient analysis are presented in Table 4.30.

Table 4.30: Coefficient of Combined influence of Water Resource Management Tools on Sustainability of Projects in Nyangores River Sub-catchment Basin.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.110	0.139		8.012	0.000
	Enabling environment	0.154	0.059	0.150	2.616	0.009
	Institutional Structures	0.130	0.042	0.197	3.095	0.002
	Management Instruments	0.218	0.063	0.216	3.481	0.001
	Infrastructure Development	0.153	0.036	0.230	4.312	0.000

The regression coefficient results in Table 4.30 show that the multiple linear regression coefficient indicate significant influence of combined water resource management tools and sustainability of projects in Nyangores river sub-catchment basin, since the p-value 0.000< 0.05. The model was: $y= 1.110+0.154X_1+0.130X_2+0.218X_3+0.153X_4$

The model showed that enabling environment, institutional structures, management instruments and infrastructure development had statistical significance (p-value 0.000<0.05). In terms of the best predictor for sustainability of projects in Nyangores river sub-catchment basin, the best predictor was Infrastructure development, (beta = 0.230; p-value 0.000 < 0.05), followed by Management instruments (beta = 0.216; p-value 0.000 < 0.05), followed by Institutional

structures (beta = 0.197; p-value 0.000 < 0.05) and finally Enabling environment (beta= 0.150; p-value 0.000 < 0.05)

4.11 Monitoring and Evaluation on the Sustainability of Projects in Nyangores River Sub-catchment Basin.

The sixth objective of the study was to determine the moderating influence of monitoring and evaluation on the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin in Bomet county, Kenya.The respondents were therefore asked to state their opinion by indicating the extent to which they agree or disagree with the ten items derived from the indicators of this variable, and structured on a five point likert scale in which; 1=Strongly Disagree, (SD), 2=Disagree, (D), 3=Neutral, (N), 4=Agree, (A) and 5=Stronglt Agree, (SA). The results are shown in Table 4.31.

Table 4.31: Monitoring and Evaluation on the Sustainability of Projects in Nyangores River Sub-catchment Basin

Statements	SD	D	N	A	SA	Mean	SD
M&E report rarely reach the basin community members	33	79	51	73	85	3.31	1.36
	10.3%	24.6%	15.9%	22.7%	26.5%		
Community members have access to M&E reports.	84	91	59	72	15	2.51	1.23
	26.2%	28.3%	18.4%	22.4%	4.7%		
M&E approaches are not clearly explained for the members	31	87	60	72	71	3.20	1.32
	9.7%	27.1%	18.7%	22.4%	22.1%		
There are M&E trained personnel for the water resource management.	77	84	82	53	25	2.58	1.24
	24.0%	26.2%	25.5%	16.5%	7.8%		
M&E results are usually considered while planning for future strategies.	85	79	64	70	23	2.59	1.28
	26.5%	24.6%	19.9%	21.8%	7.2%		
The M&E results are readily available	76	90	84	57	14	2.51	1.16
	23.7%	28.0%	26.2%	17.7%	4.4%		
M&E is rarely done for the water resource management.	28	88	60	73	72	3.23	1.30
	8.7%	27.5%	18.7%	22.7%	22.4%		
M&E objectives, for water management, are clearly stated	76	105	62	55	23	2.51	1.23
	23.7%	32.7%	19.3%	17.1%	7.2%		
M&E plan is rarely used when carrying out farm activities.	23	189	40	0	69	2.70	1.28
	7.2%	58.8%	12.5%	0.0%	21.5%		
M&E plan is well in place	142	76	44	46	13	2.10	1.23
	44.2%	23.7%	13.7%	14.4%	4.0%		
Composite mean and composite SD=						**2.72,**	**0.44**

Item one: In the line item, M&E report rarely reach the basin community members, out of 321 respondents, 33(10.3%) strongly disagree 79(24.6%) disagreed 51(15.9%) were neutral, 73(22.7%) agreed and 85(26.5%) strongly agreed. The line item mean was 3.31 higher than the

composite mean of 2.72, this implies that M&E reports has not positively influenced the sustenance of projects since it rarely reaches the basin community members. This agrees with, Kirsty, Hulst and Kerry, (2017), who stated that, where monitoring has been done, it has revealed that limitations in our conceptualization of the basin may reduce the likelihood of achieving the basin scale objectives. Monitoring of the environmental flows is also constrained, with many projects focusing on monitoring short-term outcomes of flow events rather than long-term responses to flow regimes. The higher line item SD of 1.36, than the composite SD value of 0.43 shows the divergent opinion of the respondents.

Item two: Community members have access to M&E reports, out of 321 respondents, 84(26.2%) strongly disagree 91(28.3%) disagreed 59(18.4%) were neutral, 72(22.4%) agreed and 15(4.7%) strongly agreed. The greater line item SD of 1.23 than the composite SD value of 0.43, indicate the divers views of the WRUA members, while the lower line item mean of 2.51 lower than the composite mean of 2.72 implies that, access to M&E reports does not influence the sustainability of projects in the basin area. It implies that the WRUA members should have a better access to M&E reports to guide in their decision making and therefore influence sustainability of projects, within the basin area. This agrees with the findings by, Michelle, Linda and Graham, (2012), which stated that consistent long-term monitoring and public engagement are key and suggested that these are lessons instructive for stakeholders conducting ecosystem restoration, planning or management,

Item three: M&E approaches are not clearly explained for the members, out of 321 respondents, 31(9.7%) strongly disagree 87(27.1%) disagreed 60(18.7%) were neutral, 72(22.4%) agreed and 71(22.1%) strongly agreed. The line item mean was 3.20 higher than the composite mean of 2.72. Once again, the greater line item mean, ascertain that in actual sense, M&E approaches are not correctly and adequately perceived by the WRUA community. The line item SD was 1.32, much higher than the composite SD value of 0.43, shows divergent views of the respondents. It suggests that members need assistance to operationalize the M&E approaches as well as to appreciate its role in project implementation and consequently its sustenance. Michelle, Linda and Graham, (2012), concurred with this findings when they concluded that communicating research and monitoring data to decision-makers calls for multiple and diverse

techniques, which, similarly confirms the critical role of clearly explaining the M&E approaches to the members.

Item four: There are M&E trained personnel for the water resource management, out of 321 respondents 77(24.0%) strongly disagree 84(26.2%) disagreed 82(25.5%) were neutral, 53(16.5%) agreed and 25(7.8%) strongly agreed. The line item mean was 2.58, which is less than the composite mean of 2.72, it shows that M&E personnel, if any, are not effectively in touch with community members, therefore their services are missed. This condition has not helped in the sustenance of projects in the basin area. It implies that the WRUA community, urgently, need M&E skills and practicable M&E results, to guide in decision making. The line item SD was 1.24, much higher than the composite value of 0.43, showing the divergent views of the members.

Item five; M&E results are usually considered while planning for future strategies, out of 321 respondents 85(26.5%) strongly disagree 79(24.6%) disagreed 64(19.9%) were neutral, 70(21.8%) agreed and 23(7.2%) strongly agreed. The line item mean was 2.59 lower than the composite mean of 2.72, indicating that where M&E results have not been incorporated in decision making, implying that positive influence on sustenance of projects has not been realized. Going forward, M&E results should be sought, simplified and disseminated for use at the grass root level. On the other hand, Videira, Kallis, Antunen and Santos, (2000), all agree that the new Water Framework Directive will be at stake, unless the evaluation procedure of new plans and projects evolves into a new, multi-dimensional and multi-stakeholder participatory approach, Development of environmental flow objectives and subsequent development of intervention monitoring and evaluation is key in the adaptive management of environmental flows. The line item SD was 1.28, much higher than the composite value of 0.43 implying diverse views of the respondents.

Item six; The M&E results are readily available, out of 321 respondents 76(23.7%) strongly disagree 90(28.0%) disagreed 84(26.2%) were neutral, 57(17.8%) agreed and 14(4.4%) strongly agreed. Higher line item SD of 1.16, than the composite SD of 0.43 signifies a divergence in the views of the respondents. The line item mean of 2.51 less than the composite

mean of 2.72, does not influence influence the sustenance of projects which would be improve when M&E results are available and accessible to the decision maker, the WRUA community within the basin area.

Item seven; M&E is rarely done for the water resource management, out of 321 respondents 28(8.7%) strongly disagree 88(27.4%) disagreed 60(18.7%) were neutral, 73(22.7%) agreed and 72(22.4%) strongly agreed. The line item mean was 3.23, higher than the composite mean of 2.72, indicating that the statistics conform to the line item, that, M&E is rarely done for the water resource management; hence it ought to be done for a positive contribution to the sustainability of projects in the basin area. On the other, the line item SD was 1.31, much higher than the composite SD value of 0.43, according to the diverse opinions of the WRUA community members.

Item eight; M&E objectives, for water management, are clearly stated, out of 321 respondents 76(23.7%) strongly disagree 105(32.7%) disagreed 62(19.3%) were neutral, 55(17.1%) agreed and 23(7.2%) strongly agreed. The line item mean was 2.51 lower than the composite SD mean of 2.72, and the line item SD was 1.23, much higher than the composite value of 0.43. Despite the great variation in the views of the members, shown by the higher line item SD, the lower line item mean, disapproves the line statement, implying that, there is a consensus that the M&E objectives are not adequately elaborated for the purposes of realizing and sustaining projects in Nyangores river basin. This is contrary to the assertion by, Horne, Acreman and Richter, (2017), that M&E objective-setting is the key initial step in environmental flow planning and it subsequently provides an input into adaptation of the basin scale water management framework and provide a foundation for adaptive management of environmental flows including monitoring and evaluation. Added that this should be precisely known to all those involved in project implementation and sustenance within the basin area.

Item nine; M&E plan is rarely used when carrying out farm activities, out of 321 respondents 23(7.2%) strongly disagree 189(58.9%) disagreed 40(12.5%) were neutral, 0(0.0%) agreed and 69(21.5%) strongly agreed. The greater line item SD of 1.28, than the composite SD value of 0.43 shows divergence in respondents' opinion. The line item mean was 2.70 lower than the

composite mean of 2.72. The lower line item suggests that M&E plan should be used to improve on the sustainability of projects, in the basin. The plan will bring harmony within the various components of the projects that include both temporal and spatial aspects, ultimately raising the sustainability of projects in the basin area.

Item ten: M&E plan is well in place, out of 321 respondents 142(44.2%) strongly disagree 76(23.7%) disagreed 44(13.7%) were neutral, 46(14.3%) agreed and 13(4.0%) strongly agreed. The line item mean was 2.10, higher than the composite mean of 2.7237, and the line item SD was 1.23, much higher than the composite SD value of 0.43, represents divergent opinion of the respondents. The low line item mean, again, show that, M&E plan is not prioritized while planning for the various projects within the basin area. Incorporation of M&E plan in the projects planning, will improve on the realization of the stated objectives and sustenance of projects in the basin area. This is in line with, Yazdil, Ali, and Ata, (2017),who suggested that it is important in the context of river basin management to emphasize the process of evaluating and authorizing new water related projects and plans. Further. Added that, evaluations in many cases, have failed to account for sustainability concerns. This suggests that M&E should be planned and its process well in place to account for sustainability concerns, this was confirmed by the WRUA secretary who said;

> "*M&E department, with a committee, exist but lack facilitation. The Personnel is there but lack funding and technical skills. In the county water department, there are trained and experienced, M&E persons. Occasionally M&E results are used for planning, especially the results from sampling water for quality testing in WRMA laboratories in Kisumu. There is a poor projects follow up. Monitoring is often done physical, without documentation".* From Documentation analysis, there was; *M&E documents, available in county water department but Non in the WRUA offices"(*Source 5: WRMA official*)*

4.11.1 Correlation Analysis of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin

The correlation analysis was done using the Pearson Product Moment technique to determine the relationship between the monitoring and evaluation and sustainability of projects in Nyangores river sub-catchment basin. The obtainable values in this correlation range from -1, (perfect negative correlation) to +1, (positive perfect correlation), and no correlation when the obtained value is 0.000. Otherwise, the correlation values, 0.001 to 0.250 indicate a weak correlation, 0.251 to 0.500 indicate a moderately strong correlation, 0.501 to 0.750, indicate a strong correlation and 0.751 to 1.000 indicate a very strong correlation. The results are as shown in Table 4.32.

Table 4.32: Correlation Analysis of Monitoring and Evaluation on Sustainability of Projects in Nyangores River Sub-catchment Basin.

		Monitoring and Evaluation	Sustainability of Projects
Monitoring and Evaluation	Pearson Correlation	1	0.444
	Sig. (2-tailed)		0.000
	n	321	321
Sustainbility of Projects	Pearson Correlation	0.444	1
	Sig. (2-tailed)	0.000	
	n	321	321

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

Table 4.32 shows at 0.05 level of significance that there was a significant moderate correlation between monitoring and evaluation and sustainability of projects, ($p < 0.05$). The correlation between the two variables was($r = 0.444$), which is moderately a strong correlation. These results imply that there is a significant moderate relationship between monitoring and evaluation and sustainability of projects in Nyangores river sub-catchment basin, leading to rejection of the null hypothesis; (H_0: There is no significant relationship between monitoring and evaluation and sustainability of projects in Nyangores river Sub-catchment basin), and acceptance of the alternative hypothesis and hence the study findings conclude that, there is a significant relationship between monitoring and evaluation and sustainability of projects in Nyangores river Sub-catchment basin.

4.11.2 Regression Analysis between monitoring and evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Simple linear regression was adopted to investigate how monitoring and evaluation influence sustainability of projects in Nyangores river sub-catchment basin. The rationale for using the simple regression model was to establish how monitoring and evaluation as a predictor significantly or insignificantly predicted the sustainability of projects in Nyangores river sub-catchment basin. These are further explained in the subsequent themes:

4.11.2.1 Model Summary of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin.

The model summary sought to establish how monitoring and evaluation as a predictor significantly or insignificantly predicted sustainability of projects in Nyangores river sub-catchment basin. The regression model summary is presented in Table 4.33.

Table 4.33: Model Summary of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin.

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
	0.444[a]	0.197	0.195	0.55410	0.197	78.345	1	319	0.000

Predictors: (Constant), Monitoring and evaluation

The model summary results in Table 4.33 suggests that there is a positive moderate correlation, (R= 0.444) between monitoring and evaluation and sustainability of projects in Nyangores river sub-catchment basin and those predicted by the regression model. Table 4.33 shows that R^2 is 0.197, this indicate how much variation in sustainability of projects is explained by monitoring and evaluation. Hence, 19.7% of changes in sustainability of projects are explained by monitoring and evaluation. It implies that noticeable improvement in the sustainability of projects in the basin can be realized through a more effective monitoring and evaluation measures. Videira, Kallis, Antunen and Santos, (2000), all agree that the new Water Framework Directive will be at stake, unless the evaluation procedure of new plans and projects evolves into a new, multi-dimensional and multi-stakeholder participatory approach. It added that development of environmental flow objectives and subsequent development of intervention

monitoring and evaluation is critical in the adaptive management of environmental flows. Where monitoring has been done, it has revealed that limitations in our conceptualization of the basin may reduce the likelihood of achieving the basin scale objectives. Horne, (2017), stated that objective-setting is the key initial step in environmental flow planning and it subsequently provides an input into adaptation of the basin scale water management framework and provide a foundation for adaptive management of environmental flows including monitoring and evaluation. Monitoring of the environmental flows is also constrained, with many projects focusing on monitoring short-term outcomes of flow events rather than long-term responses to flow regimes.

4.11.2.2 Analysis of Variance of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin.

The analysis of variance was used to determine whether the model was a good fit for data analysis in the determination of the influence of monitoring and evaluation and sustainability of projects in nyangores river sub-catchment basin. The statistical results are shown in Table 4.34.

Table 4.34: ANOVA of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.054	1	24.054	78.345	0.000[b]
	Residual	97.941	319			
	Total	121.995	320			

a. Dependent Variable: Sustainability of Projects

b. Predictors: (Constant), Monitoring and evaluation

The ANOVA results from Table 4.34 shows that $p=0.000<0.05$, which indicate that the model was a good fit in predicting the influence of monitoring and evaluation on sustainability of projects in Nyangores river sub-catchment basin. Hence the regression model results is significantly better prediction of sustainability of projects in Nyangores river sub-catchment basin.

4.11.2.3 Coefficients of Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin

The study sought to establish whether there was influence of monitoring and evaluation on sustainability of projects in Nyangores river sub-catchment basin. The results of regression coefficient analysis are presented in Table 4.35

Table 4.35: Model Coefficients of Monitoring and Evaluation and Sustainability of Projects in Nyangores river basin.

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.180	0.197		5.991	0.000
	Monitoring and Evaluation	0.632	0.071	0.444	8.851	0.000

a. Dependent Variable: Sustainability of Projects

The simple linear regression coefficient results in Table 4.35 indicate that there was a significant influence of monitoring and evaluation on sustainability of projects in Nyangores river sub-catchment basin. The coefficient of the constant term, (β_0 =1.180, $p < 0.05$), and monitoring and evaluation (β_6 = 0.632; $p< 0.05$) were found to be statistically significant. Regression model for monitoring and evaluation was; $y= 1.180+0.632X_6$. This indicates that for each unit of M&E sustainability of projects in Nyangores River Sib-catchment Basin is transformed by 0.632 units. It shows that monitoring and evaluation have a positive significant influence on sustainability of projects indicated by the regression coefficient 0.632 and a p-value 0.000. The results suggest that monitoring and evaluation play an important role, and therefore every effort should be made to strengthen it for projects sustenance in the basin area.

4.12 Moderating influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin

The study sought to establish the moderating influence of Monitoring and Evaluation on the relationship between Water resource Management Tools and Sustainability of Projects in

Nyangores River Sub-catchment Basin. The amount of variation in the dependent variable were presented in two models. Model 1, showed the variations explained by the independent variables, applied on their own, while model 2, showed the variations explained by the independent variables but moderated by monitoring and evaluation. This involved determining the amount of variation in the dependent variable that could be explained by independent variables and the moderating variable, which were presented in Table 4.36.

Table 4.36: Moderating influence of Monitoring and Evaluation on the Relationship Between Water resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Correlations		
Variable	**Composite Mean**	**Composite Standard Deviation**
Enabling Environment	2.53	0.60
Institutional Structures	2.60	0.46
Management Instruments	2.78	0.61
Infrastructure Development	3.00	0.93
Monitoring & Evaluation	2.72	0.43
Composite Mean & Composite Standard Deviation	**2.73**	**0.70**

Enabling Environment, as a water resource management tool, had a line item mean of 2.53, well lower than the composite mean of 2.73, when moderated by monitoring and evaluation. It implies that the M&E moderation is relatively lower on the influence of enabling environment on the sustainability of projects in the basin area. Similarly, the lower SD of 0.60 than the composite SD of 0.70, indicate more convergent opinion of the respondets. On the Institutional Structures, the line item mean of 2.60 is again less than the composite mean of 2.73, suggesting that moderating influence of M&E on the relationship between institutional structures and sustainability of projects in Nyangores River basin is comparatively low. Convergent views of the respondents are confirmed by the lower line item SD of 0.46 that the composite value of 0.70.

The Management Instruments, on the other hand, gave a higher line item mean of 2.78 than the composite value of 2.73 to show that the M&E moderation on the influence of institutional structures on the sustainability of projects in the Basin area is relatively higher. However, the lower line item SD of 0.61 than the composite SD of 0.70 represents converging opinions of

the respondents. The fourth independent variable, Infrastructure Development, scored a line item mean of 3.00, well above the composite value of 2.73 indicating a much higher moderating influence of M&E on the relationship between infrastructure development and sustainability of projects on projects in Nyangores River Basin. Equally, a higher line item SD of 0.93 than the composite SD of 0.70 indicates divergent opinions of the respondents. Finally, M&E as an independent Variable had a line item mean of 0.72 fairly comparable to the composite value of 0.73. This indicate an equilibrium position for M&E influence as a moderator as well. In this case, the line item SD of 0.43 is less than the composite SD of 0.70, suggesting convergence in the opinions of the respondents.

4.12.1 Correlations Analysis of Moderating Influence of Monitoring and Evaluation on the relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment basin

Correlation analysis was conducted on the moderating influence of M&E on the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin, the Interaction terms, was used. The interaction terms are the product of the water resource management tools moderated by monitoring and Evaluation. Hence, Enabling environment*M&E, Institutional structures*M&E, Management instruments*M&E. and Infrastructure development*M&E. Pearson product moment correlation coefficient was used in order to establish whether M&E moderates the relationship. The correlation results are shown in Table 4.37.

Table 4.37: Correlation Analysis of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin.

Correlations

Variables		Sustainability of Projects
Enabling Environment	Pearson Correlation	0.491
	Sig. (2-tailed)	0.000
	n	321
Institutional Structures	Pearson Correlation	0.552
	Sig. (2-tailed)	0.000
	n	321
Management Instruments	Pearson Correlation	0.561
	Sig. (2-tailed)	0.000
	n	321
Infrastructure Development	Pearson Correlation	0.514
	Sig. (2-tailed)	0.000
	n	321
Monitoring and Evaluation	Pearson Correlation	0.444
	Sig. (2-tailed)	0.000
	n	321
Overall Correlation	Pearson Correlation	0.706
	Sig. (2-tailed)	0.000
	n	321

Table 4.37, shows a correlation index between the Enabling Environment and sustainability of projects in Nyangores river sub-catchment basin, "r"= 0.491, (p=0.000 < 0.05), a significant positive correlation. Correlation index between the Institutional structures and sustainability of projects in Nyangores river sub-catchment basin, "r"= 0.552, (p=0.000 < 0.05), which is a significant positive correlation. Correlation index between the Management Instruments and sustainability of projects in Nyangores river sub-catchment basin, "r"= 0.561, (p=0.000 < 0.05), again, a significant positive correlation. Correlation index between the Infrastructure Development and sustainability of projects in Nyangores river sub-catchment basin, "r"= 0.514, (p=0.000 < 0.05), significant positive correlation. While the correlation index between the

Monitoring and Evaluation and sustainability of projects in Nyangores river sub-catchment basin, "r"= 0.444, ($p=0.000 < 0.05$), which is a significant positive correlation.

The overall correlation between Water Resource Management Tools, moderated by Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin was determined, which gave a correlation, "r"= 0.706, ($p=0.000<0.05$). This is a significant strong positive correlation between Water Resource Management Tools, moderated by Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin, leading to a rejection of the null hypothesis, (7.H_0: The strength of the relationship between the water resource management tools and sustainability of projects in Nyangores river sub-catchment basin in Bomet, does not depend on monitoring and evaluation), and acceptance of the alternative hypothesis, hence the study concluded that the strength of the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin, depend on monitoring and evaluation. The corresponding mathematical model for hypothesis was; Sustainability = f (Water resource management tools, monitoring and evaluation)

4.12.2 Regression Analysis of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-Catchment Basin.

A multiple linear regression was adopted to investigate how M&E moderates the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin. The rational was to establish how M&E, significantly or insignificantly moderates the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin. These are further explained in the subsequent themes:

4.12.2.1 Model Summary of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin

The model summary sought to establish how M&E moderates the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin. The results are presented in Table 4.38.

Table 4.38: Model Summary of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin.

				Std.	Change Statistics				
Model	R	R Square	Adjusted R Square	Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	0.716[a]	0.513	0.507	0.65085	.513	83.156	4	316	0.000
2	0.737[b]	0.543	0.536	0.63119	.030	20.995	1	315	0.000

Model1. Predictors: (Constant) Water resource management tools
Model2.Predictors: (Constant) Water resource management tools and M&E

The results of Table 4.38, shows in model 1, that there is a strong, positive multiple correlation (R = 0.716) between water resource management tools and sustainability of projects in Nyangores river basin, whereas R^2=0.513 suggests that water resource management tools predicted up to 51.3% of the variations in the sustainability of projects in Nyangores river sub-catchment basin, that was statistically significant (p-value = 0.000 < 0.05). On the other hand, model 2, indicate that water resource management tools and M&E, also have a strong, positive multiple correlation, (R=0.737), while R^2=0.543, which suggests that water resource management tools moderated by M&E explains a variation of 54.3% in sustainability of projects in Nyangores river sub-catchment basin which is statistically significant, given p=0.000<0.05. Model 2, further indicate that R^2 change= 0.030 which implies a 3% change in sustainability of projects in Nyangores river sub-catchment basin is explained by the moderating influence of M&E.

4.12.2.2 ANOVA of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-Catchment Basin

The study sought to establish whether the model is the best fit for predicting sustainability of projects in Nyangores river sub-catchment basin. The results are presented in Table 4.39.

Table 4.39: NOVA of Moderating Influence of Monitoring and Evaluation Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-Catchment Basin

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	140.902	4	35.226	83.156	0.000[b]
	Residual	133.860	316	0.424		
	Total	274.762	320			
2	Regression	149.266	5	29.853	74.933	0.000[c]
	Residual	125.496	315	0.398		
	Total	274.762	320			

a. Dependent Variable: Sustainability of projects

b. Predictors: (Constant), Water resource management tools.

c. Predictors: (Constant), Water resource management tools and Monitoring & Evaluation

The ANOVA results in Table 4.39 indicated that (F-statistics = 83.156), in model 1, is significant given that p-value 0.000 < 0.05, and (F-statistics = 74.933), in model 2, is significant given that p-value 0.000 < 0.05, which, implies that the regression model results is significantly a better prediction of sustainability of projects in Nyangores rive sub-catchment basin, for both models.

4.12.2.3 Coefficient Regression of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-Catchment Basin

The study sought to establish whether there was influence of monitoring and evaluation on the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin. The results of regression coefficient analysis are presented in Table 4.40

Table 4.40: Coefficients of Moderating Influence of Monitoring and Evaluation on the Relationship Between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	0.636	0.141		4.517	0.000
	EE	-0.028	0.064	-0.025	-0.444	0.657
	IS	0.262	0.059	0.265	4.442	0.000
	MI	0.334	0.068	0.304	4.888	0.000
	ID	0.281	0.052	0.282	5.435	0.000
2	(Constant)	0.573	0.137		4.176	0.000
	EE	-0.113	0.065	-0.099	-1.747	0.082
	IS	0.193	0.059	0.194	3.252	0.001
	MI	0.284	0.067	0.259	4.233	0.000
	ID	0.242	0.051	0.242	4.756	0.000
	ME	0.276	0.060	0.260	4.582	0.000

a. Dependent Variable: Sustainability of Projects

The Table 4.40 shows the regression coefficients for the moderating influence of monitoring and evaluation on the relationship between water resource management tools and sustainability of projects in Nyangores river sub-catchment basin. Using the statistics in the first model, substituting the beta values and the constant terms, the first step in regression modeling is formed as follows: $y= 0.636-0.028X_1+0.262X_2+0.334X_3+0.281X_4$

The model showed that enabling environment, has a negative non-significant influence on sustainability of projects, indicated by the regression coefficient of -0.028, (p-value= 0.657> 0.05). Further, institutional structures have a positive significant influence on sustainability of projects, indicated by the regression coefficient of 0.262, (p-value= 0.002< 0.05), also, management instruments have a positive, significant influence on sustainability of projects, indicated by the regression coefficient of 0.334, (p-value= 0.001<0.05), as well as infrastructure development again have a positive influence on sustainability of projects, indicated by the regression coefficient of 0.281, which is significant, given (p-value= 0.000<0.05). Substituting the beta values and the constant terms from the second model, the second step in regression modeling, in which the moderator, monitoring and evaluation, is included, the following model is constructed:

$$y= 0.636-0.028X_1+0.262X_2+0.334X_3+0.281X_4-0.113X_1*Z+0.193X_2*Z+0.284X_3*Z+0.138X_4*Z$$

This indicate that by introducing the moderator, monitoring and evaluation, enabling environment, has a negative significant influence on sustainability of projects, indicated by the regression coefficient of -0.113, (p-value,= 0.0825> 0.05). Further, institutional structures has a positive significant influence on sustainability of projects, indicated by the regression coefficient of 0.193, (p-value= 0.001< 0.05), also, management instruments have a significant positive influence on sustainability of projects, indicated by the regression coefficient of 0.284, (p-value=0.000< 0.05), as well as infrastructure development which has a significant positive influence on sustainability of projects, indicated by the regression coefficient of 0.138, (p-value= 0.000< 0.05). Ultimately, monitoring and evaluation have a significant positive influence on sustainability of projects, indicated by the regression coefficient of 0.276, (p-value= 0.000< 0.05)

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter presents the summary of the findings, conclusions and recommendations.

5.2. Summary of Findings

The summary of findings is presented based on the following sub themes.

5.2.1. Enabling Environment and Sustainability of Projects in Nyangores River Sub-Catchment Basin.

Under the first objective, the study sought to establish the extent to which enabling environment influenced the sustainability of projects in the basin area. The composite mean was 2.53, which showed that the WRUA members need more of the sustainability enablers; adequate financing, political support, greater advocacy and sensitization, to raise the level of projects sustainability in Nyangores river sub-catchment basin. The composite SD was 0.60 indicating divergent views of the respondents. Pearson product moment correlation coefficient value was, $r = 0.491$ and a probability value, $p = 0.000$, which implied that there is a moderately strong positive linear correlation between these variables, again affirming that these enabling factors, if availed, have a significant positive impact on the sustainability of projects in this river sub-catchment basin. R^2 value = 0.241, which means that 24.1% improvement in the sustenability of projects in Nyangores River sub-catchment basin, is predicted by these targeted enabling environment practices. The ANOVA results showed that $p=0.000<0.05$, implying that the model was a good fit in predicting the influence of enabling environment on sustainability of projects in Nyangores river sub-catchment basin. The coefficient of determination for enabling environment and sustainability of projects, $\beta = 0.502$, indicating the proportional change in sustainability of projects due to Enabling Environment, when other variables are held constant, in Nyangores River sub-catchment basin, this was agreed by a WRUA committee member who responded that sensitization meetings have been held in the past and that has improved the Enabling Environment.

5.2.2. Institutional Structures and Sustainability of Projects in Nyangores River Sub-catchment Basin.

The study sought, in the second objective, to establish the extent to which institutional structures influenced the sustainability of projects in Nyangores River sub-catchment basin. The composite mean was 2.60 and standard deviation of 0.93 which illustrates the importance of institutional structures; fair representation of the community members in the WRUA structure, harmonious working relationship among the various stakeholders and institutions, institutional training of the members. The Pearson's product moment correlation coefficient, r = 0.552 and p-value = 0.000, indicating a strong positive correlation between the two variables. This implied that successful efforts to improve on these institutional structures would result in a significant improvement of sustainability of projects in Nyangores River sub-catchment basin. The ANOVA results indicated that the significance level, p=0.000< 0.05, hence the model was a good fit in predicting the influence of institutional structures on sustainability of projects in Nyangores river basin. The R^2 value = 0.304, showed that 30.4% change in sustainability of projects is explained by these targeted institutional structures and the coefficient of determination for institutional structures and sustainability of projects was 0.364 which explained the amount of variation in sustainability of projects due to institutional structures, when the other variables are held constant. This was supported by respondent 1, who said that there is collaboration among the various institutions; USAID, NEMA, WRMA, CAAC, LVBC, County and National governments.

5.2.3. Management Instruments and Sustainability of Projects in Nyangores River Sub-catchment Basin

The study sought to assess the extent to which management instruments influenced sustainability of projects in the basin area. The composite mean score was 2.78 and the standard deviation = 0.61, indicated that management instruments; water resource management plan, fair prices for water and water services and projects financial incentives, play a pivotal role in the sustainability of projects in in Nyangores River sub-catchment basin. This was further affirmed by the Pearson's Product Moment Correlation Coefficient, r = 0.561 and a p-value = 0.000, to mean, there is a significant, strong positive correlation between the given variables. The ANOVA results pointed to a significance level, p=0.000< 0.05, hence the model was a good fit

in predicting the influence of Management Instruments on sustainability of projects in Nyangores river basin. The amount of variation in the sustainability of projects explained by management instruments was shown by R^2 value = 0.314, this implied that management instruments account for 31.4% variation in the sustainability of projects in Nyangores River sub-catchment basin. The β value = 0.566 was the coefficient in the model for management instruments and sustainability of projects in Nyangores River sub-catchment basin. Holding other variables constant, this is the amount brought by management instruments on the sustainability of projects, in the basin area. Respondent 3 added that, piped water is paid for by the consumers and that it was initially managed by the community but now done by the county government. It was further noted that the county government raised the water prices for the consumers while the control of polluters is hampered by lack of infrastructure.

5.2.4. Infrastructure Development and Sustainability of Projects in Nyangores River Sub-catchment Basin

In the fourth objective, the study sought, to establish the extent to which infrastructure development influenced the sustainability of projects in Nyangores River sub-catchment basin. The composite mean was 3.00 and standard deviation of 0.928, which indicated the role played by infrastructure development; terraces to control soil erosion, water ways to control run-off, pans and ponds construction and maintenance, domestic rain water storage facilities and availability of dumping sites. The Pearson's product moment correlation coefficient, r = 0.514, and p-value = 0.000, indicating a strong positive correlation between the two variables. This means that the WRUA community members' success on improving this infrastructure development would lead to significant improvement of sustainability of projects in Nyangores River sub-catchment basin. The ANOVA results showed a significance level, p=0.000< 0.05, the model was therefore a good fit in predicting the influence of Management Instruments on sustainability of projects in Nyangores river basin. The R^2 value = 0.264, implied that 26.4% change in sustainability of projects is explained by these stated. The coefficient of determination for infrastructure development and sustainability of projects, β value = 0.342, which represents the amount of change in sustainability of projects predicted by infrastructure development, when there is no change in the other variables. On the other hand, respondent 4 disagrees by noting that, the infrastructure is very limited and also quite old, this is a great limitation to

pollution control and further added that office equipment, such as furniture, Computers are either completely lacking or inadequate. It was also stated that the Ponds and pans suffer from poor maintenance, siltation, unsuitable trees grown around them and lack fencing for protection and the 40 shallow pans in Itembe are heavily silted. The cost is always inflated for selfish gains, whenever funds are availed for these constructions and maintenance.

5.2.5. Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin

The study sought to examine the extent to which water resource management tools influence the sustainability of projects in Nyangores River sub-catchment basin. The statistical analysis resulted in a Pearson's Product Moment Correlation Coefficient, $r = 0.648$ with a probability value, $p = 0.000 < 0.05$, implying there is a significant, strong positive correlation between the water resource management tools and sustainability of projects in Nyangores River sub-catchment basin. The ANOVA results showed that $p=0.000< 0.05$, suggesting the model was a good fit in predicting the influence of water resource management tools on sustainability of projects in Nyangores river sub-catchment basin. On the other hand, the amount of variation on the sustainability of projects, associated with the water resource management tools, combined, was indicated by the $R^2 = 0.420$. This meant that, the combined water resource management tools, adequately and appropriately implemented would raise the project sustenance by as high as 42.0% improvement.

5.2.6. Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin

The study sought to establish the extent to which Monitoring and Evaluation influenced sustainability of projects in the basin area. The composite mean score was 2.72 and the standard deviation = 0.44, indicated that monitoring and evaluation; use of M&E plan, Objectives of M&E, utilization of M&E results, number of M&E trained staff play are important in the sustainability of projects in in Nyangores River sub-catchment basin. Pearson's Product Moment Correlation Coefficient, $r = 0.444$ and a p-value = 0.000, which implies that there is a significant, strong positive correlation between the given variables. The ANOVA results showed a significance level, $p=0.000< 0.05$, therefore, the model was a good fit in predicting

the influence of monitoring and evaluation on sustainability of projects in Nyangores river basin. The amount of variation in the sustainability of projects explained by monitoring and evaluation, indicated by R^2 value = 0.197, which means that that monitoring and evaluation account for 19.7% variation in the sustainability of projects in Nyangores River sub-catchment basin. The β value = 0.632 was the coefficient in the model for monitoring and evaluation and sustainability of projects in Nyangores River sub-catchment basin. Holding other variables constant, this is the amount explained by monitoring and evaluation on the sustainability of projects, in the basin area. Respondent 5, noted that M&E department, with a committee, exist but lack facilitation and that the Personnel is there but lack funding and technical skills. Further noted that in the county water department, there are trained and experienced, M&E persons and that occasionally M&E results are used for planning, especially the results from sampling water for quality testing in WRMA laboratories in Kisumu.

5.2.7. Moderating influence of Monitoring and Evaluation on the Relationship between Water Resource Management Tools and Sustainability of Projects in Nyangores River Sub-catchment Basin

The study sought to determine the moderating influence of monitoring and evaluation on the relationship between water resource management tools and sustainability of projects in Nyangores River sub-catchment basin. Model 1 on one hand, comprised of; Enabling Environment, Institutional Structures, Management Instruments and Infrastructure Development. This resulted in R^2 value = 0.513 which means a variation of 51.3% in the sustainability of projects in the basin area is explained by the combined water resource management tools. On the other hand, Model 2 comprised of the same, combined water resource management tools, and in addition, each is moderated by monitoring and evaluation. This resulted in a higher R^2 value = 0.543, implying that the introduction of monitoring and evaluation as a moderator, raised the results from 51.3 % to 54.3%, a positive improvement of 3.0% on sustainability of projects in Nyangores River sub-catchment basin. It therefore, confirmed that M&E moderates the relationship between water resource management tools and sustainability of projects in Nyangores River sub-catchment basin**.**

5.3. Conclusions

In the first objective, to establish the influence of enabling environment on sustainability of projects, the results showed a moderately positive correlation, and a significant change predicted by enabling environment on sustainability of projects in Nyangores River sub-catchment basin. It is therefore, concluded that enabling environment is a critical component in the sustenance of projects in Nyangores River sub-catchment basin.

The second objective, to determine the influence of institutional structures on sustainability of projects in Nyangores River sub-catchment basin, the analysis results showed a strong positive correlation between the two variables, and a significant change predicted by institutional structures on sustainability of projects in Nyangores River sub-catchment basin. In conclusion, the WRUA community members need a more effective representation, training and harmonious relationship among the stakeholders to optimize on sustainability of projects.

The third objective was to examine the extent of influence of management instruments on sustainability of projects in Nyangores River basin. The analysis indicated both a strong positive correlation between the two variables and a significant variation in the sustainability of projects explained by management instruments. It is therefore, prudent for the WRUA community members to deal with water and environmental polluters decisively, update and implement the management plan consistently, moderate the water and water service charges appropriately and ensure a higher collection of water payments.

The fourth objective was to establish the influence of infrastructure development on sustainability of projects in the basin area. The correlation between the predictor and the responds variables was a strong positive correlation which enabled the WRUA community members to realize their goal through terracing appropriately, proper maintenance of ponds and pans, protection of swampy areas by fencing and eliminating the exotic species of plants.

Fifth objective was to examine the extent of influence of combined water resource management tools on sustainability of projects in Nyangores River sub-catchment basin. There was a strong positive correlation between the variables, and a significant variation in sustainability of

projects was predicted by the combined water resource management tools. The progress towards realization of optimum sustenance of projects in the basin are anchored on all the given predictor variables.

The sixth objective was to assess how monitoring and evaluation influence sustainability of projects in Nyangores river sub-catchment basin. The results showed a moderately strong positive correlation between the predictor and the response variables. Further, a significant amount of variation in the sustainability of projects was explained by monitoring and evaluation. This suggest that, appropriate and adequate investment in M&E should be ensured to continue the realization of projects sustenance.

The seventh objective was to determine the moderating influence of monitoring and evaluation on the relationship between water resource management tools on sustainability of projects in Nyangores River sub-catchment basin. The inclusion of monitoring and evaluation in the model raised the amount of variation in the responds variable, which is sustainability of projects. In conclusion, the stakeholders have to ensure a robust M&E plan, training and implementation since the relationship between water resource management tools and sustainability of projects in Nyangores Basin depend on M&E.

5.4. Recommendations

This section highlights on the recommendations for policy and recommendations for practice.

5.4.1. Recommendations for Policy

1. The study established that water resource management tools significantly and positively influence the sustainability of projects in Nyangores river sub- catchment basin. Enabling Environment, Institutional Structures, Management Instruments and Infrastructure Development separately and combined had a strong positive correlation with the sustainability of projects within the basin area. This implies that the institutions charged with projects development and sustenance within the basin area must ensure a stringent policy that brings in a robust planning and management, in regard to these predictor variables, for the maintenance of environmental quality in pursuit of sustainable development.

2. The findings revealed that one single, most limiting factor in the realization of sustainable development within the basin, is financial inadequacy. It is, therefore, prudent that policy is put in place that will address this limitation. Policy should be realigned to explore the possibility of categorizing the basin development projects as part of the Constituency Development so as to benefit from the Constituency Development Funds, (CDF) or creating a Basin Development Fund, (BDF) under the National or County governments.

3. The findings further revealed that monitoring and evaluation was unfamiliar to most of the respondents. However, monitoring and evaluation, moderated the relationship between the combined independent variables and the dependent variable, which implies that M&E could be used to serve as a tool for improving social, economic and environmental conditions within the basin area and to coordinate the basin use. Policy needs to focus on M&E as a critical ingredient of the projects implementation and management within the basin area.

4. Basins are bio geophysical units with a high degree of functional integrity; however, each basin is unique with enough commonality of hydrological, geomorphological and ecological characteristics for them to serve as a widely applicable operational landscape for planning and management. The policy operations, therefore, should be domesticated through appropriate by-laws in the respective counties to suit the basin conditions that exist uniquely.

5.4.2. Recommendation for Practice

1. The study found that the WRUA community members are not equally represented in the WRUA institutional structure which has led to some pocket areas, within the basin, lagging behind. This calls for a more robust representation of the community in the WRUA consultation and decision making organs to facilitate effective communication of essential information including M&E results.
2. The Basin activities are shared by many stakeholders and therefore, failure to achieve cooperation and coordination may have more serious consequences than just waste of resources and environmental degradation. The stakeholders, WRUA, WRMA, County and National governments must work harmoniously with a clear hierarchy and appreciation of each other's role.

3. Concerted effort ought to be made to create awareness on both short and long term effects of environmental and water resource pollution. The other stakeholders need to complement the efforts of WRUA in this endeavor and particularly, in bringing the car washing practice in the rivers to an end.

5.4.3. Contribution of the study to the body of knowledge

Through comparing the findings of the study with the findings in the literature reviewed, contributions of the study to the body of knowledge were established, based on the stated objectives. These are shown in Table 5.1

Table 5.1: Contribution of the study to the body of knowledge

Objective	Contribution to knowledge
To establish the extent to which enabling environment influence sustainability of projects in Nyangores river sub-catchment basin	While previous studies concluded that re-using water was the most mainstream preservation strategy, being modest and viable, current study found that there is failure to practice water re-use as a sustainability strategy in Nyangores river sub-catchment basin
To examine the extent to which management instruments influence sustainability of projects in Nyangores river sub-catchment basin.	While the previous study found that instruments in the IRB failed to provide insights into water resource evaluation, plans, demand control and regulatory tools in the basin, the current study found that management plan use has positively contributed to the sustenance of projects in the basin area
To what extent does institutional structures influence sustainability of projects in Nyangores river Sub-catchment basin.	Harmony among various institutions have positively influenced sustenance of projects within the river basin, while previous findings indicated that lack of basin organization, poor capacity building, clash between the water resource boundary, led to different regions in the same zones lack harmony in water resource management.

5.5. Suggestions for Further Research

1. Given that each basin has its unique characteristic, it would be worthwhile to do a similar study in the adjacent River sub-catchment basin such as Nyando River basin

2. The current study used M&E as a moderator, it is suggested that it would add value to knowledge when future study will assess the influence of M&E as an independent variable.
3. It was also revealed by the study that most WRUA community members felt that they are not fully engaged in WRUA basin activities. This suggests that future studies could investigate ways of promoting community involvement and participation in the basin activities.

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APPENDICES

APPENDIX I: TRANSMITTAL LETTER

TO WHOM IT MAY CONCERN

I am a PhD candidate at the University of Nairobi, currently conducting a research as partial requirement for the award of the degree of Doctor of Philosophy in Project Planning and Management. My research topic is, Water Resource Management Tools, Monitoring and Evaluation and Sustainability of Projects in Nyangores River Sub-catchment Basin in Bomet County, Kenya.

The spirit of this letter is to request you to participate as a respondent in this study by completing the attached questionnaire as accurately as possible. Kindly do so and return the completed questionnaire to the researcher. All information collected through this exercise will be used for only academic purposes.

Thank you.

Sincerely

KK

Kipkorir Kirui

L83/50467/2016

University of Nairobi, Department of Management Sciences and Project Planning.

APPENDIX II: QUESTIONNAIRE FOR THE HOUSEHOLD LEADERS

Introduction

The information sought in this questionnaire is meant for educational research purposes only and will not be used against anyone. Your responses will be confidential. No name of individuals or organization is necessary. Please answer truthfully following instructions for each question. Thank you in advance

Section A: Background Information of the Respondents

Please tick your appropriate choice.

1) Select your gender; Male ( ) Female ( )

2. Select your Sub-county

Kuresoi South ( )

Bomet Central ( )

Chepalungu ( )

Others, Specify…….

3. For how long have you lived in your sub-county?

(1 to 5) ( ) (6 to 10) ( ) (11 to 15) ( )

(16 to 20) ( ) (Over 20) ( )

4. What is your role in water resource management within the river basin in Nyangores? (Tick one, most appropriate)

WRUA member ( )

WRUA leader Committee ( ).

Business member ( )

Government Officer/Employee ( )

Institutional employee/representative ( )

Section B. Enabling Environment

This section covers the independent variable of this study. You are requested to give your opinion based on the level of agreement or disagreement with the statements on Likert scale of 1-5 where Strongly Disagree (SD) =1, Disagree (D) =2, Neutral (N) =3, Agree (A) =4 and Strongly Agree (SA) =5, Kindly tick appropriately

	Statement	**SD**	**D**	**N**	**A**	**SA**
B1	There is adequate financing for the management of projects in the basin.					
B2	No project or activity for water management purposes has ever stalled due to financial limitations.					
B3	Some basin management projects have stalled due to financial limitation					
B4	The sensitization meetings are popularly attended by the Basin community members.					
B5	There are well planned sensitization meetings on the suitable practices of water management.					
B6	There are regular advocacy forum to address water issues					
B7	Water management activities are usually guided by the given policy guidelines.					
B8	Water management policy is easily available whenever you need it.					
B9	Politicians are rarely in support of the water resource management projects.					
B10	Most politicians are always willing and ready to support in water resource management.					

Section C. Institutional Structures

This section covers the independent variable of this study. You are requested to give your opinion based on the level of agreement or disagreement with the statements on Likert scale of 1-5 where Strongly Disagree (SD) =1, Disagree (D) =2, Neutral (N) =3, Agree (A) =4 and Strongly Agree (SA) =5.

Tick appropriately

C	**Statement**	**SD**	**D**	**DK**	**A**	**SA**
C1	WRUA plays important role in water resource management.					
C2	There is a clear order of steps or hierarchy of procedure when dealing with WRUA					
C3	There is a great harmony among the various institutions concerned with the projects.					
C4	There are many species of indigenous plants and animals.					
C5	The trainings given have greatly improved the water management practices within the basin area					
C6	Community member are regularly trained and sensitized on water resource management practices.					
C7	WRUA Members are well trained on water resource management issues.					
C8	Basin community members are happy with the hierarchy of WRUA structure.					
C9	My sector representatives are actively involved in the River Basin programmes.					
C10	My sector of the basin is fairly well represented in the WRUA consultations.					

Section D. Management Instruments.

This section covers the independent variable of this study. You are requested to give your opinion based on the level of agreement or disagreement with the statements on Likert scale of 1-5 where Strongly Disagree (SD) =1, Disagree (D) =2, Neutral (N) =3, Agree (A) =4 and Strongly Agree (SA) =5, Kindly tick appropriately

D	**Statements**	**SD**	**D**	**DK**	**A**	**SA**
D1	There is financial incentive for those who preserve and manage water resource well.					
D2	Water polluters are monitored and fined accordingly.					
D3	Car washing is only done in designated points					
D4	Complains on over charging for water use are common.					
D5	Riparian management plan is well in place.					
D6	Charges for water use are fair and affordable.					
D7	The users effectively do payment for water use.					
D8	The water resource management plan is very useful					
D9	There is often financial limitations for the stated projects					
D10	There is a clear water resource management plan in the basin area.					

Section E. Infrastructure Development

This section covers the independent variable of this study. You are requested to give your opinion based on the level of agreement or disagreement with the statements on Likert scale of 1-5 where Strongly Disagree (SD) =1, Disagree (D) =2, Neutral (N) =3, Agree (A) =4 and Strongly Agree (SA) =5, Kindly tick appropriately

E	**Statements**	**SD**	**D**	**N**	**A**	**SA**
E1	The dumping sites are regularly in use by the family members					
E2	Most homes have a well-designated dumping site.					
E3	Rainwater storage facilities are common in homes/families.					
E4	Swampy areas are purposely protected to conserve water					
E5	There is known number of waste water treatment plants					
E6	Pans and ponds are regularly maintained					
E7	Sloppy areas in the farm are covered by vegetation throughout the year.					
E8	Water ways are well designed to control run-off					
E9	Ploughing is always done across the slope to retain the rain water					
E10	Sloppy parts of the farms are fairly modified by terracing to control erosion					

Section F. Monitoring and Evaluation

This section covers the moderating variable of this study. You are requested to give your opinion based on the level of agreement or disagreement with the statements on Likert scale of 1-5 where Strongly Disagree (SD) =1, Disagree (D) =2, Neutral (N) =3, Agree (A) =4 and Strongly Agree (SA) =5, Kindly tick appropriately

F	Statements	SD	D	N	A	SA
F1	M&E report rarely reach the basin community members					
F2	Community members have access to M&E reports					
F3	M&E approaches are not clearly explained for the members					
F4	There are M&E trained personnel for the water resource management.					
F5	M&E results are usually considered while planning for future strategies					
F6	The M&E results are readily available					
F7	M&E is rarely done for the water resource management.					
F8	M&E objectives, for water management, are clearly stated					
F9	M&E plan is rarely used when carrying out farm activities.					
F10	M&E plan is well in place					

Section G: Sustainability of Projects in Nyangores River Sub-catchment Basin.

This section covers the dependent variable of this study. You are requested to give your opinion based on the level of agreement or disagreement with the statements on Likert scale of 1-5 where Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A) and Strongly Agree (SA), Kindly tick appropriately

G	**Statements**	**SD**	**D**	**DK**	**A**	**SA**
G1	All the wastes, within the basin area, are treated before disposal.					
G2	There are many high income-generating initiatives within the basin area					
G3	. Water for domestic use is always safe and fit for human consumption					
G4	. Water supply is inadequate during low rain season					
G5	Besides domestic use, water is also used in other productive projects, like fishponds, irrigations, commercial ventures.					
G6	Water re-use is often practiced to conserve water.					
G7	There is sufficient water supply all the time for all purposes					
G8	Most basin activities disregard soil conservation measures					
G9	Soil is always conserved while undertaking farm practices					
G 10	Agroforestry practices are not prioritized					
G.11	Agroforestry practices are well in place.					

APPENDIX III: INTERVIEW GUIDE FOR MINISTRIES OF AGRICULTURE AND WATER AND NATURAL RESOURCE OFFICIALS.

Introduction

The purpose for this interview is to collect information Water Resource Management Tools, monitoring and Evaluation and Sustainability of Programme in Nyangores River Sub-catchment Basin. The information gathered is purely for academic purposes and it is expected that the findings from this study will significantly enhance the sustainability of the water resource programme in the river basin. These information will be handled confidentially and with academic professionalism. Kindly assist with your honest responds.

Section A: Demographic Information

1) Highest Level of Education/Qualification

2) What the concerns of your department?

3) For how long have you worked in this department?

Section B: Specific Information

1) What are some of the projects put in place to ensure sustainability of the water resource within the basin?

2) Is there political good will in the sustenance of projects for water resource?

3) How are the projects financed?

4) In your opinion, how effective is the water resource policy implementation?

5) Are there adequate physical facilities for WRUA/WRMA?

6) How is the sensitization and training schedule for members?

7) How are the traditions, cultural practices and local laws considered for the management of water resources?

APPENDIX IV: INTERVIEW GUIDE FOR WRUA/WRMA RESPONDENTS

Section A: Demographic Information

1) Highest Level of Education/Qualification

2) What the concerns of your department?

3) For how long have you worked in this department?

Section B: Specific Information

Enabling Environment

2) How much political support is there for the sustenance of projects for water resource?

3) How are the projects within the basin area financed?

4) In your opinion, how effective is the water resource policy implementation?

Institutional Structures

1) How are the species of indigenous plants and animals conserved?

2) Are there frequent trainings to sensitize the members on the need for basin sustenance?

3) How are the traditions, cultural practices and local laws considered for the management of water resources?

Management Instruments

1) What proportion of the expected water payment is realized annually?

2) How are the water polluters monitored and dealt with?

3) Are there car wash points around the rivers within the basin area?

Infrastructure Development

1) Are there adequate physical facilities for WRUA/WRMA, offices, furniture and other equipment?

2) How are the pans maintained?

3) What are the deliberate effort put in place to conserve water in the swampy areas?

Monitoring and Evaluation

1) Are the community members able to, freely access the M&E results for their consideration?

2) Is there adequate and skilled personnel to guide on M&E practices?

Sustainability of Projects in the Sub-catchment Basin

1) Is the domestic water always safe and fit for human consumption?

2) What are some of the projects put in place to ensure sustainability of the water resource within the basin?

3) How are the waste within the basin area treated and disposed?

APPENDIX V: CHECKLIST FOR DOCUMENT ANALYSIS

Category	No	Linkage To WRM Tools	Linkage To Sustainability of Programmes
Enabling Environment ➢ Extent of Water resource policy operations ➢ Advocacy/Sensitization programs. ➢ Availability of finance for WR;			
Institutional Structure ➢ Human resource trainings. ➢ Types of infrastructural facilities. ➢ Institutional Organization. ➢ Extent of culturally ascribed			
Management Instruments ➢ M&E practices: ➢ Availability and of management plan. ➢ Water pricing mechanism. ➢ Types of incentives to the WRUA members			
Infrastructure Development ➢ Application of terraces ➢ Infrastructure maintenance programmes ➢ Development of water storage facilities ➢ Waste water treatment plants			
Monitoring and Evaluation ➢ Availability of M&E plans ➢ Details of M&E results ➢ Evidence of M&E results use ➢ Frequency of M&E review			

APPENDIX VI: Water Resource Authority (WRA) South Rift

WATER RESOURCES AUTHORITY

Kericho Sub Region. Isaac Salat Road.
County Water Yard
Adjacent to Kericho County Refferal Hospital
P.O BOX 563 – 20200.
Kericho.
Cell: 0734-424585

WRA/LVSC-M/S/HRD/1/5/3/3 VOL.3 (22)
Date 26th January 2021

Deputy County Commissioner,
Bomet Central,

Dear Sir

RE: LETTER OF INTRODUCTION – KIPKORIR KIRUI ID No. 4745202;
This is to confirm that the above PhD student at the University of Nairobi department of Water Resources Planning and Management, undertaking research work for academic purposes has requested this office to allow him interview Nyangores Water Resources Users Association (WRUA) in Nyongores sub basin in Bomet Central and Chepalungu sub counties during the month of February 2021.

The same student is hence introduced to your office, any assistance accorded to him will be appreciated.

Sincerely Yours,

Chrispinus Wafula
Sub Regional Manager.

Paul Rono
Chairman, Nyangores WRUA,

Kipkorir Kirui,

Chairman
Department of Water Resources Planning & Management,
University of Nairobi.

APPENDIX VII: National Commission for Science, Technology and Innovation, (NACOSTI), Research License

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **469917**

Date of Issue: **02/March/2021**

RESEARCH LICENSE

This is to Certify that Mr.. KIPKORIR Charles KIRUI of University of Nairobi, has been licensed to conduct research in Bomet on the topic: Water Resource Management Tools, Monitoring and Evaluation and sustainability of Projects in Nyangores River Sub catchment basin in Bomet County, Kenya for the period ending : 02/March/2022.

License No: **NACOSTI/P/21/9121**

469917

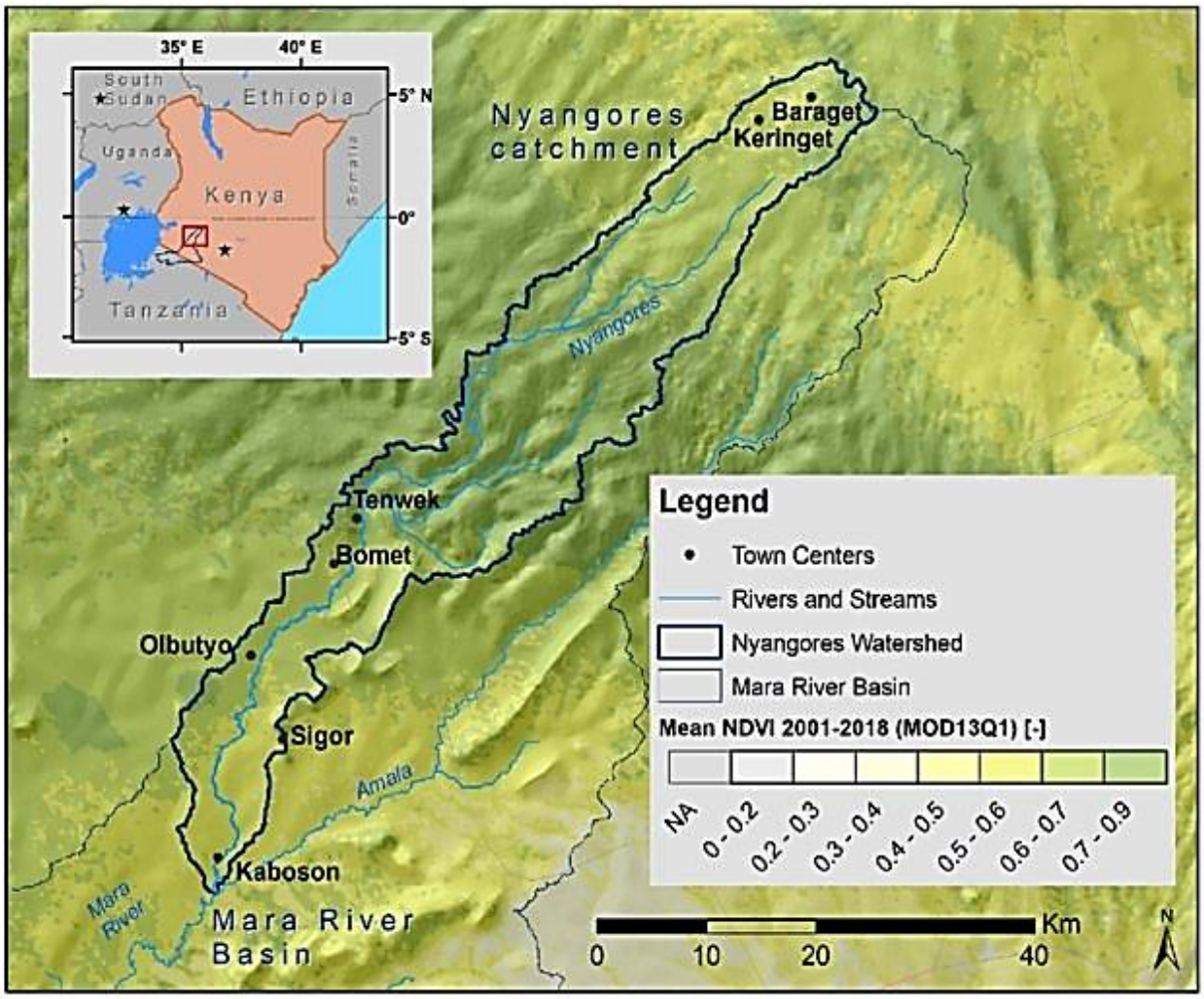
Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

APPENDIX VIII: Map of Nyangores Sub-Catchment Basin



APPENDIX IX: Krejcie and Morgan (1970)

TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size
"S" is sample size.

Krejcie, Robert V., Morgan, Daryle W., "Determining Sample Size for Research Activities", Educational and Psychological Measurement, 1970.