

**GOVERNANCE STRUCTURES AND MANAGEMENT DYNAMICS IN LARGE
SCALE COMMON PROPERTY RESOURCES
Cases from Lake Victoria Fishery, Mwea Rice Irrigation System and Laikipia Group
Grazing Lands in Kenya**

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DECLARATION

I declare that this is my own original work. It is submitted for the fulfilment of the academic requirements for the award of Doctor of Philosophy in Economics, University of the Witwatersrand, Johannesburg, South Africa. This work has not been submitted to this or any other university for any other degree or examination.

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DEDICATION

With love for my dear children, Rachael and Nathan the joy of my life.

Also, for my brother Prof. Afrifa Kibo Gitonga, who instilled in me the value of education and believed in me.

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ACRONYMS AND TERMS

ALDEV	- African Land Development Unit
ARB	- African Resettlement Board
AMREF	- African Medical Research Foundation
AWF	- African Wildlife Forum
ASALs	- Arid and Semi-Arid Lands
BMU	- Beach Management Unit
CBOs	- Community Based Organizations
CoK	- Constitution of Kenya
CPR	- Common Property Resource
CETRAD	- Centre for Training and Integrated Research for ASALs Development
CCRF	- Code of Conduct for Responsible Fisheries
CGL	- Communal Grazing Lands
DoF	- Department of Fisheries
<i>Ex ante</i>	- Before the event
EAC	- East African Community
EMCA	- Environmental Management and Coordination Act
FMP	- Fisheries Management Plan
FAO	- Food and Agriculture Organization
FBOs	- Faith Based Organizations
GEF	- Global Environmental Facility
GoK	- Government of Kenya
GTZ	- German Technical Cooperation Agency
HIV/AIDs	- Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
HMF	- Holistic Management Framework

<i>In situ</i>	- Situated in the original, natural or existing place or position
IRIRI	- International Institute of Rice Research
IMT	- Irrigation Management Transfer
IDM	- Integrated Development Model
IAD	- Institutional Analysis Development
ICIPE	- International Centre of Insect Physiology and Ecology
JICA	- Japan International Cooperation Agency
KALRO	- Kenya Agricultural and Livestock Research Organization
KEPHIS	- Kenya Plant Inspectorate Services
KMC	- Kenya Meat Commission
KLDP	- Kenya Livestock Development Policy
KWS	- Kenya Wildlife Services
LWF	- Laikipia Wildlife Forum
LVDP	- Lake Victoria Development Programme
LVEMP	- Lake Victoria Environmental Management Project
LVBC	- Lake Victoria Basin Commission
LVFO	- Lake Victoria Fisheries Organization
MRIS	- Mwea Rice Irrigation Scheme
MIWUA	- Mwea Irrigation Water Users Association
MIAD	- Mwea Irrigation Agriculture Development Centre
MRM	- Mwea Rice Millers Limited
MSY	- Maximum Sustainable Yield
MLRI	- Mpala Livestock Research Institute
NACOSTI	- National Commission for Science, Technology and Innovation
NCPB	- National Cereals and Produce Board

NDMA	- National Drought Management Authority
NGO	- Non-Governmental Organization
NRT	- Northern Rangelands Trust
NCT	- Naibunga Conservancy Trust
NEMA	- National Environmental Management Authority
NIB	- National Irrigation Board
O&M	- Operation and Maintenance
PIM	- Participatory Irrigation Management
PCC	- Person Protective Clothing
QR	- Qualitative Research
SRI	- System of Rice Intensification
SD	- Sustainable Development
SDGs	- Sustainable Development Goals
UN	- United Nations
WRMA	- Water Resources Management Authority

ABSTRACT

The world is facing a sustainability crisis due to depletion and degradation of environmental and natural resources faster than they can be generated. Many of these resources are not partitioned by private property rights, and are held as state property, common property, or as open-access. Common Property Resources (CPRs) have two distinct attributes: (1) limited or nontrivial exclusion (it is difficult to exclude multiple individuals or users from appropriating from the resource) and (2) subtractability (the resource features rivalry in consumption), meaning that appropriation by one reduces the overall resource availability and thus, subtracts from what can be appropriated by others. Examples include fisheries, grazing lands, irrigation systems, and ground water basins. Because no one has property rights or control over such resources, users of CPRs are frequently assumed to be caught in an inescapable dilemma - overexploitation of the resource. Thus, unlike the ‘invisible hand’ of Adam Smith in competitive markets, in the case of CPRs the self-interested behavior does not yield economic efficiency or optimal outcome or Pareto optimality.

This study sought to understand the evolution of management dynamics and operation of governance structures developed by resource users and other stakeholders in three large scale CPRs in Kenya. The objectives are to (1) examine the evolution of management dynamics. (2) Examine the management model applied and its functioning. (3) Explore the governance structures and challenges of implementing them. (4) Explore critical variables related to user groups, institutional arrangements and external environment in the resource system. (5) Suggest measures to improve on the management and governance of the resource system. In addition, the study gives a comparative analysis of the management models applied in the three CPR systems.

The general theoretical literature on CPRs has focused mainly on two basic but important conditions or categories. First, small scale communally owned and governed resources, in

terms of the physical or geographical size of the resource system with well-defined boundaries. Secondly, group or users size, characterized by small numbers with similar identities and interests. This study therefore, contributes to literature by using large scale CPR case studies in terms of physical size of resource system and number of users and examining the evolution and dynamics in the management model and governance structures.

A Qualitative Research (QR) methodology is adopted and analytical tools of institutional analysis and an empirical foundation based on field data applied. A survey research design is used. Both primary and secondary data was sourced and a pilot study was conducted to test reliability of research instruments. Data is documented, compiled and presented in form of tables, figures and general descriptions. Data analysis and synthesising is done by working through the data to arrive at a conclusion to answer the research questions and achieve the purpose of the study.

The study findings show that management and governance issues in the three CPRs have evolved over time both in terms of the scale and involvement of other stakeholders in decision-making process in the resource system. Specifically, the collaborations among state agencies, other stakeholders and resource users through their associations has enabled monitoring and enforcement not only be effective but also legitimate and consequently, lead to sustainable resource use. The management models used in the three CPR case studies are identified as the Partnership Fisheries Management (PFM) in Lake Victoria fishery, Participatory Irrigation Management (PIM) in Mwea Rice Irrigation Scheme and Holistic Management Framework (HMF) in Laikipia group grazing lands. The governance structures applied in the three CPRs are generally position, boundary, choice or authority, aggregation, information, payoff and scope rules. The degree of application of each set of rules however, depends on the nature of the resource system. They are designed, developed, implemented, monitored, enforced, sanctioned and arbitrated by the resource users, state lead agencies,

departments and ministries and other stakeholders or actors. Each of these actors are involved in varying degrees in the various phases depending on their role and interest in the resource system. The management and governance structures can be strengthened and improved by enhancing certain administrative, health, safety, environmental issues and increased state support and involvement in the resource system. The co-management model design which is applied in the three CPRs yield various benefits to the resource-dependent community, public, state and resource system because it incorporates state and local (resource users) managers in decision-making. However, the degree of participation of other stakeholders, challenges faced and other internal and external factors, depend on the nature of CPR, ownership and control of the CPR by resource users and the technical infrastructural investments required for the operation of the system. These results add to existing knowledge on Sustainable Development (SD)-environment nexus by providing facts to multidisciplinary environmental and natural resources scholars regarding the dynamics of large scale CPR systems. Provide an in depth understanding of CPR management issues for the formulation of national strategies for SD, fisheries, Arid and Semi-Arid Lands (ASALs), and irrigation farming. Lastly, they provide ways of responding to increasing challenges of shared water resources (Lake Victoria) in addition to strengthening of relations within the East African Community (EAC).

Key words: Actors, bio-physical and community attributes Common Property Resources, governance structures, institutions, large scale, management models, resource users, resource system.

CHAPTER ONE

INTRODUCTION

1.1 Introduction of the Study

Many natural resource systems are not partitioned by private property rights¹; hence they may be held as state property or common property (among a defined user group where rules-in-use exist regarding access and joint use) or they can be open-access. The term Common Property Resource (CPR) is used to describe a type of natural or economic good that is better defined as a Common-Pool Resource, that is, a resource that is shared among several users (Commons, 1968). CPRs' ownership status may be based on tradition or culture, or because certain resource stocks such as air, ground water, or open-sea fisheries are fugitive resources that cannot be effectively partitioned and privately owned. Since no one has property rights or control over such a resource, users of such CPRs are frequently assumed to be caught in an inescapable dilemma - overexploitation of the resource. Schlager and Ostrom (1992) identify five property rights that are relevant for the use of common-pool resources as access, the right to enter a defined physical area and enjoy non-subtractive benefits. Withdrawal, the right to obtain resource units or products of a resource system. Management, the right to regulate internal use patterns and transform the resource by making improvements. Exclusion, the right to determine who has access and withdrawal rights, and how these rights may be transferred and alienation, the right to sell or lease management and exclusion rights. CPRs may be owned by national, regional, local governments, communal groups, private individuals, corporations or be used as open-access resources by whoever can gain access. A CPR therefore, is a property rights system in which resources are managed collectively by a group, for example, fisheries, irrigation systems and grazing lands.

¹ Property right is an enforceable authority to undertake actions during a specific domain.

Since the publication of Garrett Hardin's article 'The Tragedy of Commons' in 1968, much of research interests around poverty, environment and natural resource degradation has risen substantially. This concept has been used to explain overexploitation in fisheries, forests, overgrazing in common lands, air and water pollution, misuse of public lands, population issues, extinction of species, misallocation and extraction of fossil fuels, ground water depletion, and other issues in natural resource use and management. In the absence of property rights over natural resources and lack of enforcement, that is, when there is open access, no individual resource user bears the full cost of resource degradation. This leads to free riding and overexploitation, what Hardin called the tragedy of commons (Adhikari, 2001). Using historical and contemporary evidence scholars of the CPRs have shown that resource users often create institutional arrangements and management regimes that help them allocate benefits equitably, over long-time periods, and with only limited efficiency losses. They are also confronted with the problem of how to reduce or eliminate externalities related to resource management. These scholars advocate conditions under which communal arrangements compare favourably with private or state ownership not only on efficiency criteria but also on equity and sustainability. They further indicate the underlying rights and powers of access, use, management, exclusion, and transferability that are conferred through rules governing resources (Agrawal, 2001). Grimble and Welland (1997) stresses the need to evaluate distributional and social effects as a part of holistic approach or procedure for gaining an understanding of a CPR system and assessing the impact to that system. This is done by means of identifying the key actors or stakeholders and assessing their respective interest in the system. The findings of such research would be influential in better informing policy makers about institutional support structures that would facilitate efficient or optimal and equitable resource management regimes at the local level (Gibson, Ostrom & McKean, 2000).

Most studies on CPRs have focused on two basic important conditions or categories: small scale communally governed resources in terms of the physical size of the resource system with well-defined boundaries; and group (users) characterised by a small number of users, shared norms, past successful experiences (social capital), appropriate leadership, interdependence among group members, heterogeneity of endowments, and homogeneity of identities and interests (Agrawal, 2001). In addition, these studies do not consider or analyse the governance and management issues from the resource users' and their associations perspective. Similarly, the application of Partnership Fisheries Management (HFM), Participatory Irrigation Management (PIM) and Holistic Management Framework (HMF) models in the CPR and large scale physical size of the resource with undefined boundaries are not considered. Neither the implications of trans-boundary shared natural resources nor other significant internal and external factors that affect the sustainability of the resource system are identified. Other pertinent issues in CPRs not analysed are the group (users) characteristics in terms of large number of users, the heterogeneity of endowments, diversity of the resource dependent community in terms of clan, ethnicity, identities and interests and the role and interest of other stakeholders in the CPR. This study addresses all these limitations in each CPR by using large scale CPR case studies in terms of physical size of resource system and number of users and examining the evolution in the management model and governance structures. It identifies the key actors or stakeholders and their respective role and interest in the resource system. It also informs policy regarding institutional support structures and measures for efficient, equitable and sustainable resource management and governance at the local level. Further, this study compares the management models used in the three case studies, that is, the Partnership Fisheries Management in Lake Victoria fishery, Participatory Irrigation Management in Mwea Rice Irrigation Scheme and Holistic Management Framework in Laikipia group grazing lands.

The study is carried out in three types of large scale CPRs in Kenya that is, Lake Victoria fishery, Mwea Rice Irrigation Scheme and Laikipia group grazing lands. Kenya is in the eastern part of the vast continent of Africa and forms an integral part of the Eastern Africa region. According the 2009 National Population Housing Census, Kenya has a population of 38, 610, 097 million people (Kenya Open Data, 2014). The focus of the study is to empirically explore the nature of institutions, rules and norms developed by the resource-dependent community or group in collaboration with other stakeholders who have diverse roles and interests to protect against the overexploitation of the specific CPRs; and consider the evolution and operation of these structures in a dynamic socio-geo-political and economic perspective. These three CPRs are selected because they are the largest in the country in terms of the physical size of the resource system and group or users' characteristics and thus meet the large-scale criteria. There is ample data available on them which makes field work feasible and results of the study significant in the broad spectra of academia, national, regional and international arena.

In large scale CPRs, the governance structures differ from those in small scale CPRs because the autonomy of resource users to develop, design, enforce, monitor, sanction and arbitrate is limited in the sense that, other stakeholders are involved in all these stages to form a management system (Ostrom, 2005). This is done in view of ensuring national and broader social benefits of sustaining the resource system. These include meeting national development goals, undertaking physical, financial, administrative, technical, Research and Development (R&D) investments. Abating resource system degradation, mitigate conflicts among users and offer opportunities for resource rehabilitation projects. Entering agreements and treaties, provide enabling legislation and enforcement. Apply regulatory standards and offer appeal mechanisms. Ensure distributive equity of benefits and reduce monitoring and enforcement costs. Involvement of other stakeholders in large scale CPRs management and

governance is done by information sharing and exchange, consultation, cooperation, communication, advisory roles, joint action, partnerships, community control and inter-area coordination. In the three case studies, this is manifested by various stakeholders involved and their specific roles and interests in the resource system (Ostrom, Gardner and Walker, 1994). These include organizations such as financial institutions, international organizations, Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs), Faith Based Organizations and other lead agencies, government ministries, departments, agencies local (now County) authorities, research and academic institutions, development partners, donors, and collaborators.

Although environmental and natural resources use and management is receiving increasing attention in development research and policy in Kenya, not much has been done at the micro level regarding CPRs. Much of what exist are macro or general studies focusing mostly on the Sustainable Development-environment nexus, for example, United Nations Environmental Programme Country Reports; and Ministry of Environment, Water and Natural Resources Annual Reports. Most studies have focused on different issues and challenges and not much on management and governance in the specific CPR. In Lake Victoria for example, they have concentrated on its biodiversity and ecology, water pollution, the plight of workers in the fishing industry, the water hyacinth invasion, water transport and ports and conflict resolution between the countries that share the lake resources (Kwena, Camlin, Shishanya, Mwanzo & Bukusi 2013). In Mwea Rice Irrigation Scheme, focus has been mostly on its economic and business viability, changing management and development design in terms of ownership and control between the government and farmers, financing of inputs and assets and marketing of rice produce. Others on proper land utilization, planning and multiple crops, water productivity and saving, new rice technologies, flooding and water borne diseases (Ndiiri, Mati, Home & Uphoff, 2012; Kabutha & Mutero, 2002). Studies done

on Laikipia group grazing ranches have tended to concentrate on land tenure issue, conservation or eco-tourism, impact of natural resource management programs, conservation of biodiversity, pastoralists-farmers conflict, human-wildlife conflict and large-scale private commercial livestock ranches (Lara, 2011; Ogeto, 2007; Ngethe, 1993).

The study focuses on CPRs which have two distinct attributes: (1) limited or nontrivial exclusion - it is difficult to exclude multiple individuals or users from appropriating from the resource and (2) subtractability - the resource features rivalry in consumption, meaning that appropriation by one reduces the overall resource availability and thus, subtracts from what can be appropriated by others (Hackett, 2011). This indirectly implies that there is competition and rivalry among users when they harvest resource units or use the resource system. In the case of the Lake Victoria fishery, an individual fisher who is a member of a Beach Management Unit (BMU) cannot prevent another from accessing and harvesting fish stocks from the fishery consequently and fish stocks harvested by one fisher are no longer available to others. In the Mwea Rice Irrigation Scheme, all rice farmers who are members of the Mwea Irrigation Water Users Association (IWUA), have land access and user rights and all share proportional units of the irrigation water in the system. In the Laikipia group grazing lands, all members of the group ranches under the umbrella Naibunga Conservancy Trust (NCT) have access and grazing rights in the grazing lands hence, units of pastures grazed on by a group rancher are not available to others.

The three case studies provide information on the critical variables related to resource systems, user groups, institutional arrangements, and external environment. This further justifies this study in terms of using different CPR systems case studies as indicated by the nature of resource system, method of use and extraction or harvesting. Review of historical, traditional or cultural relationship between the resource system and users; and degree of state involvement in the use and management of the resource. The nature of Lake Victoria fishery

is characterized by the fish stocks as the units of the resource, which are harvested by fishing activities in the lake. The users (fishers) have had a close and intimate association with the fishery that spans hundreds of years and the cultural and traditional belief systems defines this relationship. Prior to colonization of Kenya by the British, the fishing community had the full control to use and manage the fishery but during and after colonization up to the early 1990s, the fishery was controlled and managed to a large extent by state. The Mwea Rice Irrigation Scheme has land and irrigation water as the resource system, on which rice crop is grown and harvested by users (rice farmers). The rice farmers do not have an intimate or community traditions and cultural relationship with the irrigation system because the scheme was a colonial settlement scheme for the natives. Consequently, the use and management of the irrigation system has been largely controlled by the state. The Laikipia group grazing lands resource system is a plateau of grasslands (pastures) where livestock rearing takes place in organized group ranches. The users (group ranchers) have centuries old intimate relationship with the resource system, specifically, the Maasai ethnic group, who were pastoralists before being settled in the group ranches by the Government of Kenya. The state has a great influence in the use and management of the resource system due to the nature of the resource (Land) which requires judicial regulations.

Given the significance of natural environment and its component part of natural resources as evidenced by goal number 15 of the Sustainable Development Goals (SDGs), which is to sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss. This study will be useful in various ways. Academically, the results will add to existing knowledge on the issue of Sustainable Development-environment nexus specifically, by providing facts to multidisciplinary environmental and natural resources scholars regarding the dynamics of large scale CPR systems. Nationally, the results will provide an in depth understanding of how local CPRs can be effectively managed, especially

to the National Steering Committee which was gazetted in 2007 to prepare a national environmental policy. This information is also significant for formulation of national strategies for Sustainable Development, fisheries resources, Arid and Semi-Arid Lands (ASALs) management and irrigation farming. Regionally, it will provide ways of responding to challenges of shared water resources (Lake Victoria) and strengthening of relations within the now revived East African Community (EAC). At international policy level, the results will contribute to the assessment of/ or Kenya's National Progress Report on SDGs.

1.2 Research Objectives

The general objective of this study is to understand the evolution of management dynamics and operation of governance structures in each CPR.

1.3 Research Questions

This study is set to answer the following questions:

1. How has the management dynamics in the resource system evolved over time?
2. What management model is applied in the resource system?
3. Who are the other stakeholders, their role and interest of these in the resource system?
4. What governance structures are applied in the resource system?
5. How are these governance structures designed, developed, enforced, monitored, sanctioned and arbitrated?
6. What challenges do users and other stakeholders face in the resource system?
7. What other factors (internal and external) affect the management and governance of the resource system use?

8. What measures can be suggested to improve the management and governance of the resource system?
9. How do the applied management model designs in the three CPRs compare to each other?

1.4 Scope of the Study

The study is conducted in Kenya's Lake Victoria fishery, Mwea Rice Irrigation Scheme and Laikipia group grazing ranches. Specifically, (1) the lakeside area of Homa Bay County, where communities that reside here are dominantly of three groups of which 73 per cent are Luo, Abasuba 14 per cent and Abaluyia 12 per cent. These ethnic groups have had a historical association with the fishery with about 43 per cent of the fishers having been fishing for over 11 years, while 57 per cent for less than 11 years (Abila et al, 2000). (2) Mwea Rice Irrigation Scheme located in Kirinyaga South District of Kirinyaga County (Kenya Open Data, 2014). (3) The 13 group grazing ranches located in Laikipia North district (Laikipia Wildlife Forum, 2014). The study focuses on CPR issues in terms of governance structures and evolution in their management in general and specifically, on impacts in human welfare and consequently resource sustainability.

1.5 Methodology

The study adopts a Qualitative Research (QR) methodology, which entails finding out what happens, how it happens and why it happens that way. The plan or structure used to conduct the study is a cross-sectional survey research design. The study is at a group level in the three case studies that is, the fishers, rice farmers and group ranchers. The target population comprised of officials of the Beach Management Units in Lake Victoria fishery. Officials of Mwea Irrigation Water Users Association in MRIS. Officials of the 9 group ranches under the Naibunga Conservancy Trust in Laikipia North District. Representatives from various

organizations and institutions working with the fishers, rice farmers and group ranchers respectively. Using stratified sampling, a sample from the target group was selected. Primary data was collected using structured interview guides addressed to the target population, informal face-to-face discussions and general observation of the community behaviour; and secondary data was sourced from relevant documents and publications by government, organizations and institutions. The validity and reliability of the data collection instruments was determined by consulting experts in QR and carrying out a pilot test in each case study and then Cronbach Alpha coefficient was used on the results. An Alpha of 0.8 was obtained and consequently the instruments were deemed reliable. Data is presented in form of tables, figures and general descriptions; then data analysis and discussion done by synthesising it to draw conclusions and answer the research questions to achieve the purpose of the study.

1.6 Structure of Thesis

The rest of the thesis is structured as follows: Chapter two gives a general literature review, theoretical and conceptual frameworks and empirical evidence in CPRs. Chapter three describes and outlines the research methodology, data presentation and analysis procedures. Chapters four, five and six give specific descriptions, data presentation, analysis and discussions of the three CPR case studies in Kenya, that is, Lake Victoria fishery, Mwea rice irrigation system, and Laikipia group grazing ranches respectively. Chapter seven gives a comprehensive summary of findings, recommendations, and conclusion of the study.

CHAPTER TWO

LITERATURE REVIEW, THEORETICAL AND CONCEPTUAL FRAMEWORK

“In an over-appropriated (or overexploited) world, a system of the commons leads to ruin.... Even if an individual fully perceives the ultimate consequences of his actions, he is most unlikely to act in any other way, for he cannot count on the restraint his conscience may dictate being matched by a similar restraint on the part of others”. Garrett Hardin, Carrying Capacity as an Ethical Concept (1967).

2.1 Literature Review

Common Property Resource Regimes

Hardin’s tragedy of commons argument has been formalized by Runge (1984) in form of the classic Prisoner’s Dilemma Game with the disturbing conclusion that rational people cannot agree on collective outcome. However, where the situation is enduring or a recurrent one (in repeated game), the logic changes and free riding remains a possibility but not an imperative. This outcome is due to institutional failure to control access to resources, and to make and enforce internal decisions for collective use. This institutional failure Runge (1984) argues, could be because of internal reasons such as, the inability of users to manage themselves; or external reasons for example, an incursion of outsiders. Pressure on the resource due to growth in human population, technological change, or economic change including new market opportunities may compromise the communal-property mechanisms for exclusion. The social and political characteristics of the users of the resource and their relationship with the larger political system, which may affect the ability of the local groups to organize and manage communal property. The use of governance structures and inclusion of other stakeholders in the management of CPRs positively impacts the outcome of collective action, where instead of the tragedy of commons, the resource system is durable and sustainable (Runge, 1984).

There are many theoretical problems facing those who appropriate from a CPR for extended periods of time, for example, the difficulty in developing physical or institutional means of excluding beneficiaries, problems of congestion, overuse and potential destruction unless harvesting or use limits are designed and enforced. Examples around the world exist of both successful and unsuccessful efforts to govern and manage CPRs by government, communal groups, cooperatives, voluntary associations, and private individuals or firms (Adhikari, 2001). When these efforts are made together by the resources users and other interest groups or stakeholders, then the higher the probability of success in governing and managing the CPR.

According to Bromley (1991), the property-owning group may vary in size, nature, and national structure across a broad spectrum. It is a social unit with definite membership and boundaries. They have certain common interests, with at least some interaction among members, common cultural norms and often with their own endogenous authority system. However, despite the heterogeneity in the size, nature and national structure, most CPRs use the homogeneity attributes to govern and manage the resource system efficiently. In most literature on common pool resources managed under communal property regimes, it was thought that CPRs were unstable and pressure from free riders were inevitable, leading to the degradation in the tragedy of the commons. However, more analysis of the foundations of common property regimes and closer investigation of management of collective goods in developing world, suggest that common property regimes are not only viable, but in some circumstances essential (Bromley, 1991).

Seven characteristics of CPRs as Stevenson (1991) indicates, are deemed as a set of necessary and sufficient conditions for a successfully managed common property: (1) the resource unit has bounds that are well defined by physical, biological, and social parameters.

Common property is a social institution which controls the demarcated resource, that is, the physical or intangible asset that the group owns. (2) There is a well-delineated group of users who are distinct from persons excluded from resource use. The former group consists of identifiable, countable number of users and the latter of a set of persons who do not have the right to use. (3) Multiple included users participate in the resource extraction or use. (4) Explicit and formal or implicit and informal well-understood rules exist among users regarding their rights and duties to one another and about resource extraction or use. They include how rights are transferred, financial obligations of a user to the group, the contributions of each user, and how rules are changed or amended. (5) Users share joint, nonexclusive entitlement to the *in situ* or fugitive resource prior to its capture or use. This means that the user may have a secure expectation of getting units of physical product but not about possessing physical units; and that participants have simultaneous *ex ante* claim on any unit of the resource. (6) Users compete for the resource and thereby impose negative externalities on one another. Competition among users is in such a way as to make mutual capital investments and assist each other in resource management and utilization. In addition, extraction by one user of the resource may generate negative externalities for other users. (7) A well-delineated group of rights of holders exists which may or may not coincide with the group of users. This means that resource users and resource owners (those who hold the rights) are not always coincident. A common property rights holder (resource owner) may rent their resource use rights to the actual users, subject to the condition that the right holders be a group of people who fulfil the institutional criteria for common property. These conditions may or may not simultaneously hold, hence the degree of success in CPR governance and management will to a large extent depend on how clearly these parameters have been defined and applied (Stevenson, 1991).

Management of Common Property Resources

Transaction costs are the costs of arranging, monitoring, or enforcing agreements; the costs associated with all the exchange that takes place within an economy (Cheung, 1969). Randall (1972) defines transaction costs as, “the cost of obtaining information, establishing one’s bargaining position, bargaining and arriving at a group decision, and enforcing the decision made’. Coase (1960) argues that identifying relevant parties, collecting pertinent information, conducting negotiations, enforcing agreements, and so on, could be sufficiently and significantly costly to prevent many transactions from being achieved. Dahlman (1979) categorizes transaction costs into search and information costs, bargaining and decision costs and policing and enforcement. He asserts that these costs “represent resource losses due to lack of information”. Transaction costs are closely related to externalities in the management of CPRs. An externality is defined as an outcome of an economic activity that is experienced by unrelated third parties. It can be either positive, such as a technological innovation or invention by a firm that benefits not only the firm but also society in the form of technological knowledge or negative, such as pollution. In the presence of externalities, social benefits (costs) and private benefits (costs) differ, leading to inefficiency in resource allocation (Dahlman, 1979).

Hanna (1995) argues that, CPR management experience collective action problems in the form of negative externalities because of lack of knowledge as well as information asymmetry both at the stage of designing and enforcing governance structures. Thus, there cannot be externalities without transaction costs which in the case of CPRs, fall under collective information, decision making, bargaining operation, monitoring and enforcement costs. CPRs users must bear (internalize) these costs to get an efficient outcome - of maximizing social welfare. In CPRs, immediate and costly contributions are incurred by resource users when they enter agreements to initiate collective action or agree to exchange

or transfer goods and services, and these costs can form a significant part of resource use. Hanna (1995) gives the different resource management stages in which these costs are incurred as a description of resource context, which includes users, processors, markets, and analysis of social and economic characteristics of all resource interests. A regulatory design, which requires information describing the resource context and its dependent on the quality of contextual information provided. Implementation of a regulation, which is a critical test of how a regulation is fit to its contexts. Monitoring and enforcement of agreed upon rules which helps ensure compliance with regulations to minimize costs. This further requires that monitoring systems are designed to be consistent with resource dynamics or users' operations.

Efficient management of CPRs according to Hanna (1995), faces challenges due to various sources of uncertainty that result in high transactions costs of resource management. In the case of individual resource users, these costs relate to participation, opportunity cost of time involved in meetings, time required to acquire information and communication, direct monetary expenses for travel, communication and information. These costs directly affect management effectiveness and efficiency of collective action, and in the case of the community level, they are borne by the poor community members. Consequently, the transaction costs exceed the benefits from collective action (Hanna, 1995). Transaction costs disincentives may be minimized if more of the poorer resource users see environmental management, such as conservation of natural resources, as an important part of their way of life and not just an economic enterprise. However, due to their limited exposure and shorter time horizon, poorer resource users are more concerned about the extent of transaction costs of resource management and often disregard longer term considerations of resource conservation, which might be a constraint on their participation (Adhikari, 2001).

Agrawal, (2000), confirms that the possibility of cooperation in such games depends on a low future discount and on the availability of retaliatory strategies that are credible in the sense that, if some defects, it must be in the interest of others to effect retaliation. Existence of transaction costs may also have important distributional aspects, for example, sizeable fixed transaction costs related to participation (that is mandatory start-up costs contributed by members) may discourage poor community members from entering community-based management because their use (and hence benefits) of natural products from the CPR is comparatively small. The probability of collective action is likely to be larger in groups that are small, where members are family related, where members interact in other activities rather than single action. When members have few other options besides sharing a common resource and where there has been a history of cooperation. In addition, within a group, the probability of cooperation is likely to be higher in activities that are repeated very often as opposed to one-time activities. Where there is a commonly accepted set of norms and there is a common information base about the benefits and costs of the collective activity. Where short-term benefits from defection are low relative to the long-term benefits from cooperation (Agrawal, 2000).

Birmer and Wittmer (2000), categorizes transaction costs of natural resources into: (1) transaction costs of decision-making incurred during the process of acquiring various information prerequisites to making appropriate decisions, costs of coordinating activities (meetings or conflict resolutions), and costs arising due to delayed decisions. (2) Transaction costs of implementing these decisions which influence the incentives of those carrying out implementation activities to comply with the management decisions made. The presence of asymmetrical information, the measurability of the outcome, the possibilities to use social control for monitoring and the damage caused in the case of non-compliance.

In addition, Birmer and Wittmer (2000), highlight economic literature which suggests that the incentive to compliance depends on the direct benefits from compliance as compared to defection. Thus, the value that resource users put on the management decision and degree of members' compliance on these obligations greatly influence the incentives for compliance. The extent of group obligation is directly related to both the cost of producing the joint good and the degree of dependency among members. Consequently, the degree of members' compliance with the obligations is directly related to the monitoring and sanctioning capabilities of the group. The costs of monitoring and sanctioning can be quite high in most cases thus the degree of cooperation success will depend on the mechanisms the group adopts to economize on or lower these costs. This can be done by increasing the user participation in decision making processes, which legitimizes compliance.

Birmer and Wittmer (2000), then conclude that in developing countries, where resource dependency is very high, the number of users is comparatively large, spatial extension and poor infrastructure make monitoring costly, conservation measures are care-intensive and irreversible damage may occur; user participation in CPRs is essential. CPR regimes permits exclusion of non-group members from access to the resource system. Binding agreements need to be created on rates of extraction and on sharing costs and benefits in collective ownership to prevent overuse of the CPR system caused by users who do not consider the consequences of their actions on other users.

Common Property Resources Management Models

Four broad schools of thought emerge from literature of common property on institutional arrangements to solve the problem of over exploitation and degradation of CPRs and consequently, avert the tragedy of commons. (1) The property rights school which holds the view that this can only be done by creating and enforcing private property rights or

privatization of the resource (Demsetz, 1967). (2) State regulation school advocates that the allocation of full authority to regulate the commons to an external agency, in other words a state property regime. (3) The self-regulation school believes in the assurance problem approach which is based on voluntary compliance, this is a system of decentralized collective management of the resource by its users (Berkes, 1989; Wade, 1987; Jodha, 1986; Chopra et al, 1989). (4) Co-management school which is a hybrid regime which combines centralized and decentralized state and community institutions. In practice, every society has its own means and adaptations to deal with natural environment CPRs, its own Cultural Capital and local level systems of resource use and management based on the knowledge and experiences of the resource users (Berkes & Folke, 1994).

In the property rights or privatization or capitalist model, it is argued that resources held as CPRs are subject to overexploitation and consequently degradation and the only viable solution to this problem is to internalize its costs by privatization of public resources (Runge, 1984). According to neoclassical economists, population growth has exerted pressure on commons leading to the tragedy of commons outcome, as individuals maximize personal gains without bearing the costs. That through privatization, an individual maximiser will manage resources in a rational manner by putting it to the best and highest valued use, consequently leading to an optimal outcome in the market. They further assume that markets are the best means of allocating public resources and that competition leads to appropriate management (Vernon, 1988).

According to Gurung, (2005) evidence from the capitalist societies suggest that the model is subject to debate because it does not put into account the complexity of local social structures by isolating a single causal factor - overpopulation. A variety of interrelations in CPRs are overlooked and poor people are deprived of their public resources since people who are

already privileged and thus have more access to resources are the ones who privately own them. Consequently, poor people are forced to use the remaining marginal resources which in turn accelerate the rate of overexploitation and degradation. In addition, it leads to inequality in a system which is already plagued with unequal distribution of wealth. The local cultural system and socio-political institutions that are closely associated with CPR management are overlooked. Gurung (2005), concludes that the market has failed to regulate resource distribution and management as evidenced in many developing countries such as Nepal and India where resource allocation is regulated by the caste and social class position. That the benefits of the privatization or capitalist management model include the rationality in individual decision making, efficient allocation of public resources and appropriate management of resources through market competition.

However, it has its limitations too, in that its argument is based on a single factor - population - yet local social structures are quite complex and dynamic, it overlooks various interrelations between the resource system and users, resource distributive benefits accrue to the rich people who can afford to buy them, poor people are pushed to the marginal resources which leads to overcrowding, overexploitation and degradation, it leads to inequality in society and local economic, social, political and cultural CPR management institutions are undermined (Gurung, 2005).

The state regulation or socialist model argues that economic poverty caused by inequitable distribution of CPRs among rural populations is the driving force of resource degradation. Thus, an equitable strategy of resource management would entail 'collectivization' or nationalization of public resources. Although the model does not accept population aggregation parameters as the main cause of the tragedy of commons, it analyses the increasing rate of population in historical and more socially complex manner. For example, in

poor families or societies, family size reflects rational economic decisions, with high cost-benefit ratio of extra-children, since children contribute economically in agriculture labour or informal economy of the household throughout their lives (Hetch, 1985). It is further argued that environmental problems have their origin in structured poverty among rural populations; hence the point of analysis should focus on historical and political variables that underlie reproductive choices. Nationalization as a mechanism of equalizing process could prevent individual maximisers from overexploiting resources and bring major transformations of social relations as well as basic attitudinal and behavioural changes of the resource users (Gurung, 2005).

This model like the privatization one does not recognize the complexity of local structures by emphasizing only economic relations and overlooks various interrelations in CPRs. The model reduces everything to an economic cause and overlooks the other multiple causal factors, such as cultural, political, historical and institutional relations. State ownership and control of public resources have not solved the problem of CPR management as illustrated by nationalization of forest resources in Nepal, where the problem of deforestation persisted (Fenny, Berkes, McCay & Acheson, 1998). The nationalization program undermined the local system of management and mitigated obligations of community to protect their natural resource. Ekvall (1986) and Goldstein (1990) as cited in Gurung (2005) reported similar situations from Tibet; consequently, the governments of Nepal and China recreated communal property rights of the local communities. This policy model has not proved practical as evidence from Eastern Europe indicate that environmental conditions in socialist countries are emerging and are as equally damaging as in capitalist countries (Cockburn, 1989). The weaknesses of the state regulation or socialist model lie in the fact that it does not consider the complexity of the resource system and local community structures. It overlooks other interactions from a social, cultural and political point of view by considering only

economic ones. It undermines the local systems of daily operations by resource users. The main strengths of the model are that it analyses CPR issues from a historical perspective and in a more socially and politically detailed manner. It recognizes that environmental problems emanate from structural poverty and can deter individual users from overexploitation and misuse of resources.

The self-regulation or decentralized collective management or anthropological model has been advanced by social scientists; particularly cultural anthropologists with focus on analysing and understanding various cultural strategies adopted by local communities to manage CPRs. Empirical evidence suggests communal system as the best solution to the problem of CPR management. Their premise lies in the assumption that people who depend on natural resources for their livelihood have always developed certain cultural systems and socio-political institutions to regulate their relations with nature (Gurung, 2005). Steward (1995), refers to these systems and institutions as the 'cultural core' and are related to the subsistence activities and economic arrangements; which serve as dynamic adaptive mechanisms to the environment unless they are threatened by external forces. Community management strategy is effective because residents have both the most stake in, and information about the CPRs. However, its success is mostly in small-scale homogeneous society that has stable population and environment or ecology (Uphoff, 1986). Cultural anthropologists, political scientists and political economists agree that efficient management of CPRs is a determinant of the economic development of a society; and that local institutions can play an effective role in resource management.

However, they differ in opinions that all social institutions cannot manage and sustain all types of CPRs effectively and equitably. Uphoff (1986) distinguishes five kinds of community management of forest, rangeland, irrigation and water, watershed and soil

conservation or cropland management. That community management system is appropriate and effective if resource users are an identifiable group and the resource is certain. For example, user groups can be more effective in the case of irrigation management where users are geographically delimited and the resource can be distributed with precision. In rangelands management, some form of high level authoritative decision-making institution is desirable to deal with membership and resource ambiguities arising because herders have greater mobility as they seek alternative grazing lands and users are not easily identifiable. In the case of forest management, the resource is geographically fixed and bounded but users are not as limited as in irrigation water and it is harder to form and maintain users' associations on voluntary basis thus, an authoritative and inclusive body such as local government becomes more effective.

Uphoff (1986), further argues that the self-regulatory or decentralized model recognizes the role of local cultural and socio-political institutions and appreciates the centuries old adaptive relationships developed between the resource system and its users. The model is however limited by its applicability to small homogeneous communities with stable populations. Rigid systems of resource management engraved in the cultural and traditional systems. Negative perceptions of modern methods of resource use and management and the fact that its applicability depends to a large extent on the nature of the resource system and characteristics of the group (users).

In the co-management school which is a combination of centralized, decentralized and community institutions this is done by designing the responsibilities of management in such a way that it takes advantages of both state and local managers, which increases the potential of the CPR management to succeed. Its basic rationale is grounded in both efficiency and legitimacy. The efficiency argument is two-fold: (1) both higher quality and less costly

information is available (upon which to base management decisions), through a combination of local knowledge in the functioning of an ecosystem and scientific knowledge produced by state agency scientists. (2) By being local and oversight by state regulators interjecting some measure of accountability to the larger collectively monitoring and enforcement can be more effective. Involvement of user-groups and community members enhance the legitimacy of the system, consequently, people become more willing to voluntarily comply with the requirements placed upon them (Singleton, 2000). This according to Michael (1996) affirms the assertion that any good system of governance depends on such horizontal and vertical social capital.

Singleton (2000) suggests that a more useful way to evaluate co-management is to consider the ways its establishment disrupts the settled routine of relations between different sets of actors and in so doing, creates new opportunities for both competition and cooperation and for the exercise of control and resistance. That to establish and maintain a successful co-management regime, two major institutional and design problems must be solved. First, how states and communities can create effective institutions in situations where they both have shared and competing interests. Second, how having created such institutions, each party can avoid its agents corrupted or having its interests 'captured' (when an agency identifies its interests as so tightly intertwined with the interests of those they have been charged with regulating such that they no longer have the inclination to defend the broader public's interest or their own agency's independent) by the other.

Thus, Singleton (2000), asserts that a relatively efficient division of labour between a state agency and a community co-managing a CPR might involve four steps. First, the state agency gathers and analysis information about the status of the resource system and uses this information to generate various alternatives that are consistent with long term sustainability.

Secondly, the two parties negotiate shares and general parameters of regulatory measures aimed at reaching those harvest targets, as well as, a schedule for long-term investments designed to enhance or maintain the productivity of the system. Thirdly, both parties develop specific regulations to govern the harvesting of the shares. Then finally, communities bear primary responsibility for implementation and enforcing regulations governing their members with periodic oversight by state agencies. The co-management model is lauded for its efficiency based on higher quality and less costly information and accountability in monitoring and enforcement of governance rules. Enhancement of legitimacy of the user groups through their participation and involvement in decision making. Creating opportunities for both competition and cooperation. Enabling users to exercise control and resistance. Allows state agency and user groups to create effective institutions even though both have shared and competing interests in the resource system. Both parties can avoid their agents being corrupted or captured by the other.

We can thus conclude that based on the benefits and limitations of these models, the co-management model tries to balance among various interests of the state and resource-dependent community, consequently, ensuring improved human and social welfare and sustainability of the CPR. Due to the large scale of the three case studies and state intervention strategies in natural resource use and management; the adopted management model or regime is the co-management. This has ensured that institutional and design problems are solved to establish and maintain sustainable CPR regimes. In the case of Lake Victoria fishery, the state agency is the Department of Fisheries, in Mwea Rice Irrigation Scheme it is the National Irrigation Board and in Laikipia group grazing lands the Department Livestock and Veterinary Services all in the Ministry of Agriculture, Livestock and Fisheries.

Governance of Common Property Resources

Using historical and contemporary evidence from locally situated small user groups and communities Wade (1987) and Ostrom (1990), have shown that resource users often create institutional arrangements and management regimes that help them allocate benefits equitably, over long-time periods and with only limited efficiency losses. Generally, all CPR users are confronted with the problem of how to reduce or eliminate externalities related to resource management. From cases of successful local management of CPRs, scholars and policy makers advocate the use of a combination of state, private and common property governance structures and management models to ensure efficiency, equity and sustainability. The protection of the underlying powers of access, management, exclusion and transferability. Consequently, modern governance structures and management models in CPRs are using a combination of state, private and common property regimes to ensure optimal outcome in resource use.

Four basic categories give the conditions that are considered important in determining how CPRs users interact with the resource system on a daily and continuous basis. First, the resource system characteristics which include small size and well-defined boundaries. Second, group characteristics which include small size, clearly defined boundaries, shared norms, past successful experiences (social capital), appropriate leadership (young, familiar with changing external environments, connected to local traditional elite), interdependence among group members, heterogeneity of endowments, homogeneity of identities and interests. The relationship between system characteristics and group characteristics is reflected by an overlap between user group residential location and resource location. High levels of dependence by group members on resource system and fairness in allocation of benefits from common resources. Third, institutional arrangements which mean rules are simple and easy to understand, locally devised access and management rules, ease in

enforcement of rules, graduated sanctions, availability of low cost adjudication and accountability of monitors and other officials to users. The interaction between resource system and institutional arrangements lies in trying to match restrictions on harvests to the regeneration of resources. Fourth, external environment which incorporates technology (low cost exclusion technology), state or central government should not undermine local authority, supportive external sanctioning institutions, appropriate levels of external aid to compensate local users for conservation activities and nested levels of appropriation, provision, enforcement and governance (Agrawal, 2001).

Preference for a polycentric approach as opposed to centralized, decentralized or markets is evidenced in Anderssen and Ostrom (2008). They argue that in polycentric approach multiple centres of decision making are independent and overlapping in their roles. In polycentric resource systems, local users develop rules that guide individuals' behaviour but does not necessarily imply complete decentralization or absence of strong government (Huitema et al, 2009; Ostrom, 1990; Ostrom, Walker & Gardner, 1994; Pahl-Wostl & Knieper, 2014). Instead governance is shared between national and local actors. National laws preserve local user groups' ability to devise local rules and establish systems for coordination between user groups; and create complementary, overlapping systems for enforcing local rules that are adapted to the unique social and biophysical conditions at sub-national scales (Baldwin et al, 2015).

An intricate web of a cause-effect nature is created, where the resource system characteristics determine the type of group features manifested. The institutional arrangements in turn are developed by the resource users based on the resource system characteristics and group features. To do this, resource users consider the external environment which includes the prevailing technology, state and other stakeholders. In the three case studies, governance

structures developed by all stakeholders (including the state) are used to ensure efficiency in resource use, equitable distribution of benefits and sustainability. In addition, these governance structures help in reducing or eliminating externalities, transaction costs and free riding related to resource management. The participation of resource users (fishers, rice farmers and group ranchers) is essential because of the large number of users, geographical (spatial) extension, and poor infrastructure that make monitoring costly, care-intensive conservation measures and irreversible damage may occur,

2.2 Theoretical Framework

Institutional Analysis and Development in Common Property Resources

To explain behaviour in a collective-action environment, the Institutional Analysis and Development (IAD) framework is used. The IAD has its roots in classical political economy; neoclassical microeconomic theory and institutional economics, public choice theory, transaction-cost economics and non-cooperative game theory. IAD has been used to analyse various issues among them CPR problems, (Oakerson 1992; Ostrom 1990; Ostrom 1992; and Thomson, Feeny & Oakerson 1992). The first step taken in an institutional analysis of IAD is the identification of a conceptual unit referred to as action arena, which becomes the focus of analysis, prediction, and explanation of behaviour and outcomes within fixed constraints. This action arena has two components namely, an action situation and an actor (Ostrom, Gardner & Walker, 1994).

The action situations according to Ostrom and others (1994), refer to ‘the social space where individuals interact, exchange goods and services, engage in appropriation and provision activities, solve problems, or fight (among the many things that individuals do in an action situation)’. All situations are viewed as being composed of the same set of elements for example, in markets, hierarchies, and legislatures. A minimal action situation is characterized

using seven clusters of variables: (1) Participants, who include the actors who have become participants in a situation and are the element that links actors to an action situation. (2) Positions are place holders to associate participants with an authorized set of actions (linked outcomes) in a process, for example, appropriators in CPRs. (3) Actions are the set of actions or decisions that participants in specific positions can take at different stages of a process, for example, decisions to fish or not to fish during a defined time. (4) Potential outcomes are the outcomes that participants can potentially affect through their actions as they interact with one another in a regularized setting, for example, the physical conditions of an irrigation system. (5) Transformation functions that map actions into realized outcomes.

These are set of functions that map participants (and/or random actions) at decision nodes into intermediate or final outcomes; they can be either determinate or stochastic in nature, for example, in a fishery, biologists may not yet understand the factors that determine the relationship between fishing effort in the current period and availability of fish stocks in the next period. (6) Information is closely related to the type of transformation functions as a set of information available to a participant in a position at a stage in a process. In a simple and determinate transformation function, complete information about actions, outcomes, and their linkages may be generated. (7) Payoffs are the costs and benefits assigned to actions and outcomes. Payoffs are different from outcomes because they are the method of assigning positive and negative weights to the outcomes and the actions leading to outcomes, for example, the cost of travelling to a fishery or the price of rice offered to the irrigator for produce sold in the market. Thus, action situations can be viewed as the resource system where in the three case studies are the Lake Victoria fishery, Mwea Rice Irrigation Scheme and the Laikipia group grazing lands. The interactions of these variables within an action situation are intertwined in almost a seamless web such that it is hard to tell where one

situation ends and another begins. For example, when fishers move from home to nearby fishing grounds and then to a market where they sell their day's fish catch.

The actors are according to Ostrom and others (1994), the participants in action situations. To predict how actors will behave, assumptions are made regarding four clusters of variables. Firstly, individual preferences, which are preference evaluations that actors assign to potential actions and outcomes. Individuals are presumed to be able to construct a complete order of preference over outcomes to which payoffs are assigned. Secondly, individual information-processing capabilities, that is, the way in which actors acquire, process, retain, and use knowledge contingencies and information. It is assumed that individuals have complete information in terms of the actions that each participant can take at every stage of a decision process and those that are governed by random operator. The intermediate and/or final outcomes that can be reached because of the moves of various participants combined with chance moves where applicable. The preference ranking placed by each participant on all outcomes. Thirdly, individual selection criteria, which actors use for deciding upon course of action. The assumption is that with complete information and infallible processing, actors maximize expected utility, compute best responses, or obey the minimax criterion. Fourthly, individual resources are the various resources that an actor (a single individual or a group functioning as a corporate actor) brings to a situation. All actors are assumed to possess sufficient resources to take any of the actions available to them. Thus, individual or group actors make logical, fully informed and efficient decisions with sufficient resources that they possess to take any actions available to them. In the three case studies, the actors include the fishers, rice farmers, group ranchers and other stakeholders involved in the governance and management of the respective CPRs. Certain factors affect action arenas: (1) the rules individuals use to order their relationships; (2) attributes of a physical world; and (3) the nature or attributes of the community within which the arena occurs. It is important to

consider how rules affect the structure of action arenas or situations by linking rules and actions (games) created by rules, the biophysical world and communities (Ostrom et al, 1994).

Rules

Ostrom (2005), argues that central to the analysis of institutions is the concept of rules; a term used to denote regulations, instructions, precepts, and principles. In the context of CPRs, it is used in the sense of regulations, to refer to something laid down by an authority as required of certain persons (or alternatively, forbidden or permitted). One can meaningfully therefore refer to activities such as the rule being announced, put into effect, enforced (energetically, strictly, laxly, invariably, occasionally), disobeyed, broken, rescinded, challenged, revoked or reinstated. Thus, generally, rules can be thought of as a set of instructions for creating an action situation in a environment. Rules are defined as shared undertakings by participants about enforced prescriptions concerning what actions (or outcomes) are required, prohibited, or permitted. All rules are the result of implicit or explicit efforts to achieve order and predictability among human, which when well-understood and enforced, operate to rule-out some actions and rule-in others. Rules need not be written nor result from formal legal procedures; rather, institutional rules are often self-consciously crafted by individuals to change the structure of repetitive situations that they themselves face in an attempt to improve the outcomes that they achieve (Ostrom, 2000).

Ostrom (2000), further asserts that the rules that individuals use in action situations have their origin from different sources in open democratic governance systems and it is considered legal and proper for individuals to self-organize and craft their own rules if the activities they are engaged in are legal. When individuals generally participate in crafting of many rules, most of the crafting will occur as problem-solving individuals interact trying to figure out

how to improve or better perform their tasks. For a deeper institutional analysis, it is important to understand the working of rules that individuals use in making decisions. These are the set of rules to which participants would refer if asked to explain and justify their actions to other participants. She concludes that in an open society governed by a 'rule of law' the general framework in use has its source in actions taken in constitutional, legislative, and administrative settings, complemented by rule-making decisions taken by individuals in many different settings. That is, the rules-in-form are consistent with the rules-in-use. There are three distinguished levels of rules that cumulatively affect the actions taken and outcomes obtained in any setting: operational rules directly affect day-to-day decisions made by the participants, collective-choice rules affect operational activities and results through their effects in determining who is eligible and the specific rules to be used in changing operational rules and constitutional-choice rules affect operational activities and their effects in determining who is eligible and the rules to be used in crafting the set of collective-choice rules that in turn affect the set of operational rules (Ostrom, 2005).

In a study of the governance and management of irrigation, inshore fisheries, and forest institutional around the world, Ostrom (2005) provides empirical studies of rules related to CPRs to illustrate the variety of rules found to exist. These include: (1) Position rules, which is the set of positions or anonymous slots that are filled by participants and to which specific action sets are assigned at junctures in a decision process. They are the connecting link between participants and authorized actions. (2) Boundary rules also known as entry and exit rules which define who is eligible to enter a position. The process that determines which eligible participants may (or must) enter positions and how an individual may leave (or must) leave a position. (3) Choice rules which specify what a participant occupying a position process considering conditions that have, or have not, been met at that point in the process. (4) Aggregation rules which determine whether a decision of single or multiple participants is

needed prior to an action at a node in a decision process. (5) Information rules which authorize channels of information flow to communicate among participants. Assign obligation, permission or prohibition to communicate to participants in position at decision nodes and the language and form in which communication will take place. They are important in generating information about past actions of participants so that other participants can know who is, or who is not trustworthy. (6) Payoff rules which assign external rewards or sanctions to actions that have been taken or to readings on outcome state of variables. They directly impact the net costs and benefits of action or outcomes for actors in an action situation. (7) Scope rules which define the set of known outcomes, affect the width of the outcome space (number of state variables affected), and specify the range on each outcome variable included in the space. Thus, they describe an outcome rather than an action. Rules can thus be summed up as instructions used to order and predict required, prohibited or permitted human actions (or outcomes) and interactions. In the three cases the actors have developed and applied specific rules (and norms) to govern and manage the respective CPRs (Ostrom, 2005).

Attributes of a Physical World

The attributes of the biophysical and material world being acted upon or transformed, according to Ostrom (2005) affects some of the variables of an action situation. They include what actions are physically possible, what outcomes can be produced, how actions are linked to outcomes and what is contained in the actors' information sets. Further, the two attributes of exclusion and subtractability are used to distinguish among four basic goods: toll or club goods, private goods, public goods and common-pool resources. CPRs yield benefits where beneficiaries are hard to exclude but each person's use of a resource system subtracts units of that resource from a finite total amount available for harvesting. For example, when a fisher harvests a ton of fish, those units are no longer available to any other fisher (Aggarwal &

Dupont, 1999). In cases where exclusion is costly, those wishing to provide a good or service face a potential free-rider or collective-action problem. For example, some individuals who gain from the maintenance of an irrigation system may not want to contribute labour services or taxes to maintenance activities, hoping that others will bear the burden. CPR provisioning raises additional problems in determining beneficiaries' preferences and their willingness to pay especially where exclusion is difficult like in large groups where face-to-face discussions are not possible. In case of subtractability and where the flow of service is scarce relative to demand, users will be tempted to try and obtain as much as they can of the flow for fear that it will not be available later (Ostrom, 2005).

Thus, effective rules are required if scarce, fully subtractive service flows are to be allocated in a productive way (Ostrom et al, 1994). One allocative mechanism is to charge prices for subtractive services although this may not always be feasible in cases where some individuals will be able to grab considerably more of the subtractive services than others. Consequently, this leads to non-economic uses of the flow and high levels of conflict among users. According to Ostrom (1986), incentives of users to maintain a system is affected by allocation rules, for example, farmers located at the tail end of an irrigation system that lacks effective allocation rules have little motivation to contribute to the maintenance of that system because they only occasionally receive their share of water. Similarly, farmers located at the head end of such a system are not motivated to provide maintenance services voluntarily because they will receive disproportionate share of the water whether the system is well-maintained. The structure of action situation is also affected by a diversity of other attributes that affect how rules combine with physical and materials conditions to generate positive or negative incentives. Empirical evidence show that effective rules depend on the size of the resource; the mobility of its resources such as water, wildlife or trees; the presence

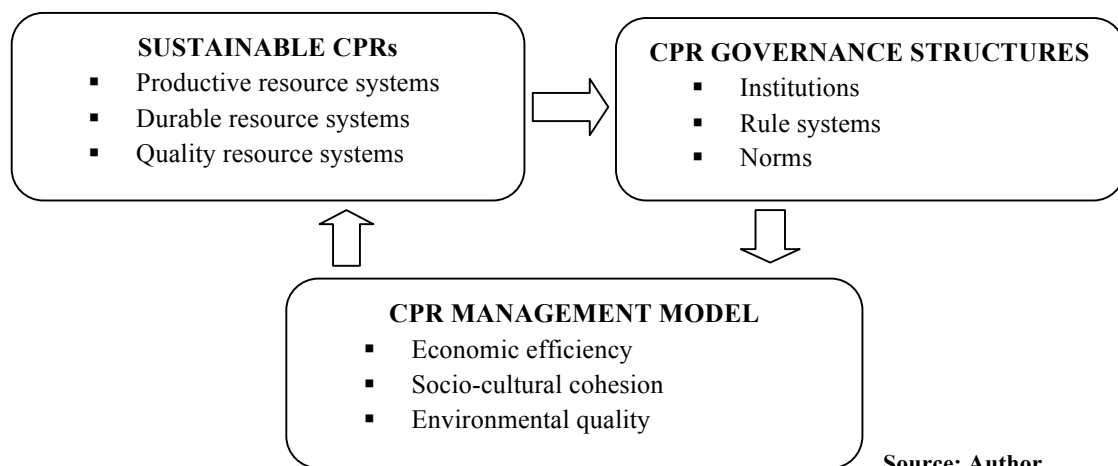
of storage in the system; the amount and distribution of rainfall, soils, slopes and elevation; and other factors (Ostrom et al, 1994).

Attributes of a Community

Another set of variables relate to the concept of community within which any focal action arena is located: the values of behaviour generally accepted in the community (or culture); the level of common understanding that potential participants share (or do not share) about the structure of action arenas; the extent of homogeneity in the preferences of those living in a community; the size and composition of the relevant community; and the extent of inequality of basic assets among those affected (Ostrom, 2005). The IAD framework uses the concept of an action arena to analyse, predict and explain behaviour and outcomes within fixed constraints. There is constant interaction between its two component parts, that is, the actions situation and actors. Other factors that affect action arenas and consequently behaviour and outcomes include: rules which once developed are available to all individuals or group actors, whether they contributed in designing and developing them; attributes of the biophysical and material world; and nature of the community in terms of its economic, social, cultural and political characteristics.

2.3 Conceptual Framework

Figure 2.1: Conceptual Framework



Source: Author

The study's conceptual framework demonstrates the interactions among sustainable CPRs, their governance structures, and management model in a feed-back-effect relationship. Sustainability in CPRs is enhanced through application or use of governance structures. This is manifested by the CPR management model adopted to balance the economic, social, cultural and environmental factors. The CPR management model ensures economic efficiency through minimization of cost and waste, enhanced socio-cultural cohesion and environmental sustainability, among others. When these interactions are improved, it results in sustainable CPRs in the economy.

Olson's Logic of Collective Action

The study uses this theory in line with the analysis of governance structures and management models applied by CPR users in their interactions with the resource. That is, it conceptualizes the problem of organizing interest groups. Mancur Olson's proposition states that 'unless the number of individuals in a group is quite small or there is coercion or some other special device to make individuals act in their common interest, rational self-interested individuals will not act to achieve their common or group interest' (Olson, 1971). In other words, to contribute to a group objective, interest group membership must be compelled or offered inducements to belong rather than be accounted for by the rational self-interested choice of individuals. If therefore there is selective punishment or inducements, individuals will free ride, consequently, the public good will not be supplied or it will be supplied in sub-optimal amounts (Wade, 1987). Thus, voluntary collective action will not produce public goods; and collective action based on selective (excludable) positive or negative incentives may produce public goods.

Olson's argument is restricted to large interest groups only, in taxonomy of small, intermediate, and large groups. In small privileged groups, the problem of free riding does

not occur because each member has an incentive to see that the collective good is supplied or provided even if it means providing it themselves. What happens is that the value to an individual (V_i) of a collective good is higher than the total cost of its production (C) and the advantage (A_i) to this individual is a positive sum. That is, $A_i = V_i - C > 0$. As the size of the group (S_i) increases, the relative importance of everyone's contribution to collective action and share or fraction (F_i) decreases of the value of the collective good for the group (V_g). Thus, $F_i = V_i/V_g$. An intermediate group is one 'in which no single member gets a share of the benefit sufficient to give him an incentive to provide the good himself, but which does not have so many members that no one member will notice whether any other member is or is not helping to provide the collective good'. Therefore, since noticeability is high for intermediate groups than for large groups, free riding is more readily detected. This makes the likelihood of voluntary collective action high for small groups, low for large groups and moderate for intermediate ones. In large groups, individual benefit is too low and transaction costs too high for collective action to be possible and contribution is too small to make a significant difference to the outcome. Free riding is prevalent and in some cases, dominates cooperation, which leads to reliance on selective incentives such as, coercion to secure support (Olson, 1971).

This theory is supported by examples such as, Agrawal & Gupta, 2005 on Nepal's Terai forest protected areas. Pomeroy & Berkes, 1997 on Canada's James Bay and Northern Quebec fisheries, Norway's Lotonfen Islands Cod fishery, Philippian Municipal or nearshore waters, and Japanese coastal fishery. Ostrom, 1994 on Nepal's Indrawati Basin of Sindhu Palchok District Irrigation systems. Agrawal & Goyal, 2001 on India's Kumaon Himalaya protected forests. Dubbink & Vliet, 1996 on Netherlands' North Sea fishery. Williams, 1998 on West African Semi-Arid CPRs in Chad, Burkina Faso, Mali and Niger. Sarker & Itoh, 2003 on Japanese Land Improvement Districts irrigation systems. In the presence of state

regulation or private property, these CPRs have become successful and the resource system sustainable.

Empirical evidence may contradict this theory, for example, in McKean, 1986 on Japan. Gilles & Jamtgaard, 1982 on Peru. Campbell & Godoy, 1985 on the Andes. Hitchcock, 1981 and Peters, 1985 on Africa. Netting, 1976 on Switzerland where users of CPRs have established rules, monitored the conditions of the resource, monitored cheating, and assigned punishment (Wade, 1987). The successful cases of these locally devised rule systems underpin the fact that it is not necessary for regulation of the CPRs to be externally imposed (McKean, 1984; Ostrom, 1986). The other shortcomings of the theory include the size argument which is defective in the sense that collective action is not a simple function of group size. That size is not always an obstacle to collective action. That freeriding is not always a dominant strategy, that is, people participate, contribute and cooperate. The assumption of self-interest is also inadequate and needs to be replaced by an assumption of mixed motivations. These may include non-economic motives such as, altruism, duty or solidarity in form of class-consciousness, assurance, sympathy, commitment, nation, community, class, gender, race and ethnicity.

We can thus conclude that in collective action, the group dynamics in terms of characteristics of resource users determine the outcome of their actions (interactions). Self-interest among users over shadow group interest, consequently leading to overexploitation of the resource. There should be some form of incentives both negative and positive to induce members to produce goods and deter any form of free riding. In small groups, freeriding is averted because benefits and costs are shared equally, monitoring and enforcement is easy and less costly and there is a high degree of cooperation. This gives individuals the incentive to produce or supply the good at an optimal level. In the three case studies, due to their large

scale, the governance structures developed and management models adopted help in ensuring optimal outcome in resource use. This supports Olson's argument of using some form of coercion to make group users achieve their common interest. However, his size argument does not apply because, despite their large scale, group users have managed to overcome the problems of overexploitation and free riding by involving all stakeholders. That is, there is participation, contribution and cooperation. In addition, other non-economic motivations are included in decision making and actions among the group users.

2.4 Empirical Evidence

The following is a review of successful localized CPRs, where users have overcome incentives to destroy the resource using management models and governance structures that they have crafted with institutional support from other stakeholders. Well documented examples of overexploitation of CPRs exist, for example, the great Canadian Fishery (Ruitenbeek, 1996); and Alpine grazing Meadows (Netting, 1976). The users of the commonly held resources have in many instances however, overcome incentives to destroy the resources and have developed long-enduring institutions or rules-in-use that enabled them to utilise these resources more effectively. For example, ground water basins in South California (Hoss, Bath, Cross & Merriner, 1999), irrigation systems around the world (Tang, 1991), and local forests in India (Ostrom, et al, 1994). Understanding the conditions under which users of the CPRs successfully develop and maintain effective institutions is critical to facilitating improved resource policies.

Fisheries

Schlager (1989) examines three types of problems faced by inshore fishers. Coastal fisheries experience CPR dilemmas, which include appropriation externalities, technological externalities, and assignment problems. Appropriation externalities arise because fishers are

withdrawing fish from a common stock without considering the effects of their harvesting upon each other. Technological externalities emerge when fishers physically interfere with each other in harvesting fish. The physical environment of coastal fisheries often promotes assignment problems. Fish unevenly distribute themselves across fishing grounds, congregating in areas that provide food and shelter. Consequently, areas of spot of fish grounds are more productive than others, with fishers desiring to fish the most productive spots. Assignment problems occur when fishers, in their uncoordinated choice of fishing spot, do not allocate themselves efficiently across spots. Problems arise over who should have access to the most productive spots and how access should be determined. Schlager develops a conceptual argument for why endogenous solutions to assignment problems and technological externality problems are more likely to develop than endogenous solutions to appropriation problems. She examines the type of rules used by 33 organized subgroups of fishers, illustrating how most of them relate to the allocation of space rather than the allocation of quantity of fish. She also finds strong evidence that fishers monitor rules they themselves create. The rules-in-use include organized fishers, boundary rules, authority rules, and scope rules.

The rules utilized by the 33 organized subgroups demonstrate attempts to resolve technological externalities and assignment problems, but not appropriation externalities, at least not directly. Boundary rules demonstrate an attempt on part of the fishers to close access to their fishing grounds, allowing only local fishers to have access. In addition, in many cases, not only must a fisher meet residency requirements, but also meet technological requirements. Once access is gained to fishing grounds, fishers are not free to engage in harvesting fish in any manner they desire; rather, a host of authority and scope rules coordinate their use of fishing grounds, these rules allocate space. Choice spots are allocated through a variety of mechanisms such as lotteries or first in time, first in sight rules. In other

cases, whole areas of fishing grounds are divided among different types of technologies. Fishers in organizing, adopt configurations of rules that define access to and use of fishing grounds.

Crean (2000) compares the development experiences of two fisheries-dependent communities: Shetland Islands located in the North-East Atlantic, and Lau community of Malaita, in Solomon Islands of Pacific Ocean. Results reveal that although the two communities differ in fisheries sector specifics, they have, over different time scales, adopted similar management strategies in the pursuit of sustainable fishing. In both cases, they have sought to support the local fisheries economy by tempering the external forces of the centre, by adapting management control and resource ownership strategies in response to social and economic turbulence in the environment. Thus, to maintain a coherent fisheries management strategy over time and a sustainable resource base requires a pro-active approach, the input of resources, and moderation of pressures created by the market.

In a study examining the role of Lake Victoria Basin Commission and other formal and informal institutions in promoting secure land and water rights in Lake Victoria Basin (LVB), results show that the growing land and water challenges in LVB has more to do with weak governance rather than resource availability. Most land and water sector institutions are weak, fragmented, uncoordinated and riddled with corruption. In addition, decision making is often top-down with no clear framework to promote stakeholder participation; administrative institutions lack desired capacity for efficient and effective performance or support competent decision-making processes; and community perception of efforts by Government of Uganda (GoU) to fight corruption is that there is lack of transparency in the sale and lease off public land (Mabikke, 2014).

Nunan (2014) examines fisheries policies that pursue multiple objectives which in some cases may be conflicting or competing such as, to create wealth or employment, generate increasing government revenues and sustain stocks and biodiversity. The case study is Lake Victoria, where three main commercial fisheries are seen to contribute different objectives of the lake's fisheries. Findings reveal that whilst there is much rhetoric in support of wealth-based approach, this has not been followed through in implementation, reflecting the lack of political support for new taxation and limiting access. The welfare functions of the fisheries are significant but could be substantially strengthened through provision of services to the fisheries communities. Without the incorporation of welfare objectives, fisheries policies will not be politically accepted or fully implemented, hence, there is need for a balance between wealth and welfare objectives and measures.

A study conducted by Cinner and others (2012), explored the transition to decentralization in marine resource management systems in three East African countries using expert opinion from both Political Science and socio-ecological systems fields and governance transition concepts: drivers of change, institutional arrangements, institutional fit, actor interactions and adaptive management. The main findings indicate that decentralized management in the region was donor-driven and only partly transferred power to local stakeholders; increased accountability created a degree of democracy in regard to natural resource governance; increased local level adaptive management has emerged in most systems; and experimental management has helped to change resource users' views from metaphysical to more scientific cause-effect attribution of changes to resource conditions (Cinner, Daw, McClanahan, Muthiga, Abunge, Hamed, Mwaka, Rabearisoa, Wamukota, Fisher and Jiddawi, 2012).

Lawrence (2015), explores the concepts of decentralization, co-management, community participation and self-organization to determine the success and challenges of the program in

Lake Victoria, East Africa. Results reveal that to accomplish community participation, it is necessary for devolution of authority, through decentralization to occur; one weakness in decentralization is the unbalanced distribution of fiscal and authoritative resources to administer management; a balance must be struck between the national government's need for profits from international markets for natural resources and the required fiscal resources for community administration to manage them; the relationship between higher levels of government and community are often weak, absent or unclear, hence communities must self-organize/govern through BMUs; and without clear lines of authority and stable financial mechanisms, community organizations lose or do not acquire legitimacy from the government and fishers consequently, the community is unable to function as a resource management organization. The study concludes that lack of support from higher political authorities undermine enforcement power at the local level and lack of financial returns from these weaknesses de-legitimizes the local level management organizations.

A study on Lake Victoria in East Africa, investigated the extent of movement around the lake; the implications of movement on how fishers participate and are represented in co-management; and the implications of the extent and nature of movement on co-management structures and processes. The findings show that participation in development reflect a top-down nature of implementation and the desire to secure participation of different occupational groups and women in a male-dominated sector; powerful boat owners dominate positions of power in the co-management system; and the limited power and resources of boat crew are exacerbated by the degree and nature of movement around the lake consequently, effective participation in co-management decision making becomes quite challenging (Nunan, Luomba, Lwenya, Ntambi, Odongkara and Yongo, 2012).

These studies are limited by the fact that their focus is on development of endogenous solutions to assignment and technological problems faced by inshore fishers or similarities in sustainable fisheries management strategies adopted by different sectors among fishing communities. Others on the growing water and land challenges in Lake Victoria Basin because of weak governance by state agencies and strengthening of welfare functions of fisheries to create a balance between wealth and welfare objectives and measures. Yet others on transition to decentralization in marine resource management and governance, enhancing community participation through devolution of authority and determining the extent of and implications of movement of fishers around Lake Victoria on co-management structures and processes. In addition, these studies do not consider or analyse the governance and management issues from the fishers' and their associations perspective or the application of Partnership Fisheries Management model in the fishery. The issue of the large scale of the fishery with undefined boundaries and group (users) characteristics in terms of large number of fishers, the heterogeneity of endowments, diversity of the fisher community in terms of clan, ethnicity, identities and interests are also not explored. Lastly, the implications of trans-boundary shared water resources, the role and interest of other stakeholders in the fishery and other significant internal and external factors that affect the sustainability of the fishery are not explored.

Irrigation Systems

Tang (1991) focuses on the CPR problems faced by who provide, maintain, and utilize irrigation systems around the world. He develops a performance measure related to both the provision and appropriation of CPRs. He uses this measure to evaluate the effectiveness of different boundary and allocation rules used by government-owned and farmer-owned irrigation systems. He also investigates the provision, the monitoring, and enforcement of rules. He finds that irrigation systems where farmers have provided their own rules tend to do

better than systems owned and operated by central government authorities. He measures performance of an irrigation system by first determining the outcomes from several different arenas, on whether: (1) a system is well maintained, (2) most irrigators regularly follow operational rules, and (3) the water supply, is adequate for all irrigators. Within the sample of 47 cases examined here, these three outcomes occur in a pattern that forms a Guttman Scale with a Coefficient Reproducibility of: $(CR) = 1 - (1/47 \times 3) = 0.94$.

For analytic purposes, Tang divided the sample into two sets: one consisting of cases that are rated as positive in both rule conformance and good maintenance; the other consisting of cases that are negative in either rule conformance or good maintenance or both. The first group (29 cases) thus represents those in which farmers are relatively successful in solving their provision and appropriation problems; the second group (18 cases) represents those in which farmers have failed to solve some of their provision and appropriation problems. This composite performance measure provides a way of evaluating the extent to which some CPR problems are solved in different irrigation systems; where the first group is classified as high-performance cases and the second group as low-performance cases.

Asmellash (2001) focuses on a locally initiated and managed irrigation system in Wareda, Ethiopia; with the objective of examining its origin, evolution and importance to the local users and the sustainable management and utilization of the resource. Results reveal that embedded in the local social, economic and agricultural practice, it continues to thrive well as a local organization with great autonomy from the state and with minimum social and institutional cost. A study by Short and others (2012), on analysing incentives and disincentives for rice in Kenya and focusing on the Mwea Rice Irrigation Scheme (MRIS), found out a highly concentrated value chain on the National Irrigation Board (NIB) scheme. Incentives arise from Kenya's tariff structure and high domestic prices due to an increase in

the cost of imported inputs. Disincentives include increase in demand for rice due to high prices and possibility of consumers substituting rice with maize, wheat and other staples. Thus, the long-term government goal is to increase rice production to meet growing domestic need for staple foods using various strategies including increasing the scheme acreage size, constructing a water reservoir dam and applying water saving technologies (Short, Mulinge and Witwer, 2012).

Nyangau and others (2012) conducted a study to determine the effects of row spacing, planting dates and irrigation depth on Basmati 370 and IR 2793-80-1 rice varieties growth and development under the System of Rice Intensification (SRI) in Mwea and Western Kenya irrigation schemes and the most useful (optimum) practices to be adopted. Results indicate that all three factors had increasing and decreasing impacts on the yields and prediction of yield for the two rice varieties. Thus, SRI outputs change with management practices employed, hence a factor to be considered to improve on rice production (Nyangau, Mati, Kulecho, Wanjogu and Kiplagat, 2015).

In a study by Ndirangu (2015), on the influence of SRI on rice production among small scale farmers in Mwea found out that rice management practices, farmers' awareness on the SRI, adaptation of SRI and farmers' perceptions of SRI influence rice production. Hence, the recommendation made was that quality management of the rice farmers associations and NIB should be enhanced to ensure proper and sufficient services to rice farmers. A study on experiences of the introduction of SRI innovation in MRIS found out that rice farmers stand to gain multiple benefits from its use including increase in rice yields, saving water and getting better grain quality. Thus, with collaborations between rice farmers and institutions through multi-sectoral, multi-level coalitions and dissemination of SRI practices need to be incorporated in the management and decision-making process (Mati, 2011).

These studies are limited by the fact that their focus is on CPR problems faced by those who provide, maintain and utilize irrigation systems by evaluating the effectiveness of governance structures in solving provision, appropriation and technological problems. Others on examining the origin, evolution and importance to the local users of locally initiated and managed irrigation system in terms of utilization and sustainable management of the resource. Yet others on analyse the initiatives and disincentives for rice with long term government goal to increase rice production. Lastly, others are on determining row spacing, planting dates and irrigation depth on rice varieties grown under the System of Rice Intensification (SRI) and optimal practices to be adopted and the influence of SRI on rice production among small scale farmers. Further, these studies do not consider or analyse the governance and management issues from the rice farmers and their associations perspective nor the application of Participatory Irrigation Management model in the irrigation system. The large scale physical size of the irrigation system and group (users) characteristics in terms of large number of rice farmers, the heterogeneity of endowments, diversity of the rice farmers' community in terms of clan, ethnicity, identities and interests which are critical issues in CPR management and governance are not considered. The role and interest of other stakeholders in the irrigation system and other significant internal and external factors that affect the sustainability of the irrigation system too have not been explored.

Group Grazing Lands

Ogato (2006) undertook a study on indigenous Communal Grazing Land (CGL) management in the Chenchu Woreda, one of the districts in Gamo Gofa Zone, South of Ethiopia. He uses the concept of indigenous knowledge and its role in resource management that local people practice through informal institutional structures. He gives three factors that helped in the existence and sustainability of CGLs in Ethiopia: cohesiveness of the user group; institutional structure in traditional resource custodianship; and rules, enforcement mechanism and

graduated sanctions. He concludes that the existence of CGLs has allowed many households including those with very small size of privately owned land to own livestock. In addition to grazing land, they have significantly improved the livelihoods of the rural people, as a source of financial income and physical capital. The features of rules of traditional management system of the CGLs and the spiritual connectedness of the community have contributed to the sustainable utilization and preservation of biodiversity. The communal use of the CPR in some ways also addresses issues of rural inequality by providing freedom of access to the poor.

Wendel (2004) uses Institutional Analysis Development framework (IAD) on the grazing lands in Botswana to examine how the institutional arrangements affect the probability for the livestock owners to govern the grazing lands. Three sets of variables are used to determine whether the resource is sustainable: the institutional arrangements, the physical attributes of the resource, and the attributes of the community. Results show that the present resource management system is not sustainable due to external factors that hinder livestock owners from investing in resource management; and recommends that the government cancels the dual grazing rights and partner with the livestock owners in making decisions on the use of water and land resources. William and others (2014) evaluated the threat-mitigation impact of Community Based Conservation (CBC) tourism lodge projects hosted by three group ranches in Kenya, these are Kijabe and Koiya in Laikipia and Elerai in Kajiado counties. Since Kenya's wildlife live outside, conservationists have adopted CBC strategies to support landscape conservation programs, for example, the African Wildlife Foundation's (AWF) CBC engagement involve an exchange of development assistance for communities to commit a portion of their land for conservation management. AWF engaged each group ranch in a participatory planning process to establish a land use plan featuring management zones for conservation, livestock grazing, settlement and cultivation. They concluded that the CBC

have variable but positive conservation impact and that their approach is accessible, straightforward and cost effective (Williams, Simba, Muruthi and Gregory-Michelman, 2014).

In a study that examines the role of three key conservation organizations, that is, the African Wildlife Foundation, African Conservation Centre (ACC) and Northern Rangelands Trust (NRT) in landscape governance in Kenya. This was informed by the fact that tourism plays a major role in the way Non-Governmental Organizations (NGOs) govern landscapes, especially in decentralized conservation context in developing countries. Upon analysing organizational strategies and practices between 2007-2013, results demonstrate that conservation NGOs, as intermediators of various forms of conservation tourism are subjected to multi-sector interdependencies; underpins the role of mismatching scale-making that not only hampers organizational objectives, but also contributes to a dynamic reshaping of conservation tourism landscapes; and illustrates this approach to landscape governance in the context of the Naibunga Conservation Trust (NCT) where multiple conservation NGOs are required to deal with overlapping and competing orderings (Pellis, Lamers, and Van der Duim, 2015).

In a 2014 study by Nthiga on lessons from governance of tourism conservation partnerships in Kenya, focuses on the role of partnerships in conservation-development nexus and related governance challenges, tourism in conservation and development and governments in regulating these kinds of partnerships. Results show that partnerships are complex and consists of 'nested' institutions; and with partnerships being part of a network of partnerships, complicates governance in in partnerships and governance of conservation development in the entire region. Partnerships as part of the Community-Based Natural Resources Management (CBNRM), are like other initiatives utilizing tourism as a strategy for

development and conservation in Africa and therefore, prone to challenges of realizing their full potential and enduring over time. Partnerships are just one form of the many other interactions addressing the tourism-conservation-development nexus, consequently, the need to create effective coordination, congruence and regulation.

The African Union (AU) in 2012 carried out a study on rational use of rangelands and fodder crop development in Africa. Results indicate various lessons, both in terms of success and failure. (1) Institutional and political: community empowerment and involvement, government support and commitment is critical in rangeland and pastoral development and involvement of grassroots organizations for transfer of technologies and dissemination of financial resources. (2) Technical and knowledge issues: logistical and technical support for successful grazing management for destocking, building on indigenous knowledge/practices and enhancing the economic values of drylands by understanding their ecological, social and institutional characteristics. (3) Ecological, economic and social: community based range rehabilitation with strong participation of women in the projects activities to build resilience of dryland communities and sustainability of the interventions, balance economic and environmental when promoting conservation and range restoration/rehabilitation measures, projects/technologies that enhance income generation for the local people record high rates of adaptation and conflict management is essential for sustainable development particularly in areas prone to resource-based conflicts such as pastoral systems. (4) Policy, governance and legal factors: land tenure remains a major challenge to the implementation of large scale range management interventions such as rotational grazing due to the multiple user nature of pastoral lands, sustainability of dryland ecosystems and pastoral development depends on flexible and mobile transhumance systems and on access to key resources, adaptation of new technologies in marginal lands is often low because of variability of returns to farmers/pastoralists and institutional constraints such as land tenure and most trans-border

natural resources tend to be most successful where governments have devolved some aspect of control over land and resource use to local groups.

In 2013, Laikipia Wildlife Foundation carried out a study on the rural economy of Laikipia as a basis for a model county. It explored the financial, social and environmental contributions of the rural economy in terms of current land use; and sustainability and potential of land uses in the context of climate constraints. Findings indicate that agriculture is the pillar of Laikipia County, especially small-scale cultivation but is not profitable or viable given the marginal climate conditions. Horticulture, ranching, pastoralism and tourism are profitable and generate high volumes of revenues and have thus taken on the responsibility for the county's social development. Small holder farming and communal rangelands (pastoralism) generate most of the county's food value. Private ranches generate high values for ecosystem services in form of water supply, soil erosion regulation, water treatment, gas regulation, pollution and soil formation.

These studies are limited by the fact that their focus is on the concept and role of indigenous knowledge in resources management that local people practice through informal institutional structures in communal grazing lands. examining how institutional arrangements affect the probability for livestock owners to govern grazing lands. Others on evaluation of threat-mitigation impact of Community Based Conservation eco-tourism projects by establishing a land use plan in terms of conservation, livestock grazing, settlements and cultivation. Yet others examine the role of conservation organizations in governing landscapes with multiple land uses and overlapping often competing orderings and balancing conservation-development activities. Lastly, others consider lessons (both success and failure) of rational use of rangelands and fodder crop development in Africa and exploring the financial, social and environmental contributions of the rural economy on current, potential and sustainable

land use. In addition, these studies do not consider or analyse the governance and management issues from the group ranchers and their associations perspective or the application of the Holistic Management Framework model in the group grazing land. Pertinent issues in CPRs of the large scale physical size of the group grazing ranches and group (users) characteristics in terms of large number of group ranchers and their livestock, the heterogeneity of endowments, diversity of the group ranchers' community in terms of clan, ethnicity, identities and interests are also not explored. Implications of diverse land use activities the role and interest of other stakeholders in the group grazing lands and other significant internal and external factors that affect the sustainability of the group grazing lands too need to be examined.

This study addresses all these limitations in each CPR by using large scale CPR case studies in terms of physical size of resource system and number of users and examines the evolution in the management model and governance structures. It identifies the key actors or stakeholders and their respective role and interest in the resource system. It informs policy regarding institutional support structures and measures for efficient, equitable and sustainable resource management and governance at the local level. This study also compares the management models used in the three case studies, that is, the Partnership Fisheries Management in Lake Victoria fishery, Participatory Irrigation Management in Mwea Rice Irrigation Scheme and Holistic Management Framework in Laikipia group grazing lands.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter links the research questions and theoretical background to the specific research methodology used in the study. First, relevant concepts or variables are integrated into analytical framework for empirical research. Second, the research procedures employed in the study are described in terms of design, target population, research instruments, data collection techniques, data processing and analysis.

3.2 Operational Definition of Terms and Concepts

The following are definitions of various terms and concepts as applicable in this study.

Common Property Resources. This is a term used to describe a type of natural or economic good or resource that is shared among several users. It is a property rights system in which resources are owned and managed collectively by national, regional or local government, communal groups, private individuals or corporations. Examples include fisheries, irrigation systems, grazing lands, forests, and ground water basins.

Governance structures. A set of institutions, norms or rule systems. That define the physical boundaries of the CPR, its users, methods and extent of appropriation and codes of conduct for users.

Management. The process of controlling natural resources by users with the goal of sustainability. This means balancing social, economic and environmental factors for the wellbeing of both present and future generations.

Large scale. This denotes the size of the CPR both geographically (physical) and the number of users. In the three types of CPRs cases, the Lake Victoria fishery covers 3,280 square kilometres and the users (fishers) population is 963,794. The Mwea Rice Irrigation Scheme covers 30,350 square kilometres and users (rice farmers) population is 528,054. The Laikipia group ranches cover 704.919 square kilometres of the 9,462 square kilometres of the county and the users (group ranchers) population is 120,000 of the 399,227-total county population (Kenya Open data).

Institutions. These are rules of the game of a society or the humanly devised constraint that structure human interaction. They are composed of formal rules (statute law, common law, regulations), informal constraints (conventions, norms of behaviour and self-imposed modes of conduct) and the enforcement characteristic of both.

Norms. The preferences about how individuals should act in a situation. For every norm, there exists a beneficiary (the party who expects to benefit from the norm) and a target (one who is expected to comply). Norms and institutions which influence norms are designed to benefit an individual or a group of individuals.

Rule systems: Stipulations about forms of behaviour (which either conform or fail to conform to societal norms) with positive or negative sanctions. Governance structures are therefore regulations or instructions laid down by the resource users as required of certain persons for creating an action situation in a CPR. These are position rules, boundary rules, choice rules, aggregation rules, information rules, payoff rules and scope rules.

3.3 Methodology

The purpose of this research led to adopting a Qualitative Research (QR) methodology, which entails finding out what happens, how it happens and more importantly, why it happens that way. That is, to give a clear and detailed account of actions and representations

of actions as possible to gain a better understanding of our world, and use this knowledge to effect social change. In QR the 'variables' are not controlled to capture this freedom and natural development of action and representation. Thus, we want to understand, explain in argument by using evidence from data and literature, what the phenomena under study are about. There are three main categories of data collection or sources or gathering methods in QR: (1) observation, (2) artifact and document studies, and (3) interviewing. Once data is documented, they should go through the process of analysis. This entails working through the data to arrive at a conclusion in which the research questions are answered to achieve the purpose of the study. The analytical instrument is largely the researcher that is, their knowledge, understanding and expertise determines what happens to the data. The researcher does this, they make meaning from the data by seeing the bigger picture and converting the 'raw' empirical information (the 'thin description' of phenomenon) into 'thick description'. This gives an account of the phenomenon (1) that is coherent, (2) gives more facts and empirical content and (3) interprets the information considering other empirical information in the same study, as well as from the basis of a theoretical framework that locates the study (Henning et al, 2009).

The researcher is unequivocally the main instrument of research and makes meaning from their engagement in the project, that is, they will present as findings what they have interpreted to be the meaning of data. The researcher then complements this with a strong theoretical base or authority argument by using respected researchers in the field as evidence, a coherent convincing argument based on both empirical evidence and the researcher's understanding and logic. The evidence comes from the data and from theory that explicates and explains the data. It is in this articulated interpretation that the understanding and explanation of phenomenon lie - not in the presentation of organized and rearranged data (Henning et al, 2009).

3.4 Research Design

According to Shaughnessy, (2003), a survey research design is the plan or structure used to conduct the entire study. This study adopts the cross-sectional design, where one or more samples are drawn from the population at a point in time. It allows the researcher to describe the characteristics of a population or the differences between two or more populations and correlation findings allows the researcher to make prediction. This approach demands selection of a representative portion of a group from the larger population. It attempts to collect data from members of that portion to determine the status of that population with respect to the stated variables.

3.5 Study Group

The study is at a group level. That is, a social unit with definite membership and boundaries, certain common interests, at least some interaction among members, and some common cultural norms and their own endogenous authority system to use or appropriate goods and services from the CPR. These are (1) the fishers, who are members of the local fishing community in the lakeside area of Homa Bay County who reside therein and enjoy all property rights in the Lake Victoria fishery. (2) Rice farmers who are members of the Mwea Rice Irrigation Scheme located in Kirinyaga County, who co-own the scheme with the government, enjoy all property rights in the irrigation system and owns land on which he/she grows rice using water and other facilities (roads, granaries, grinders, threshers) provided by the system. (3) The group ranchers in Laikipia County who are members of the 13-small scale group grazing ranches, that enjoy all property rights in the group ranch, who own and graze a given number of livestock in the ranch and use other facilities (water, dip, sheds, feeding troughs) provided therein.

3.6 Target Population

The target population is (1) officials of various Beach Management Units in Lake Victoria fishery in Homa Bay County. (2) Officials of Mwea Irrigation Water Users Association in Mwea Rice Irrigation Scheme. (3) Officials of the 9 group grazing ranches under Naibunga Conservancy Trust in Laikipia North district. (4) Representatives of Community Based Organizations (CBOs), government organizations, ministries and agencies, educational and research institutions, environmental conservation organizations, financial institutions, media and telecommunication organizations, religious organizations, Non-Governmental Organizations (NGOs) and United Nations agencies operating in these counties working with the CPR users.

3.7 Sampling Procedure

Sampling is the process involving the selection of a finite number of elements from a given population of interest, for purposes of inquiry. The first step in the study's sampling process was to identify the CPR users' association (s) and the specific organizations working with the resource users in each CPR. Stratified sampling was used to achieve this, where individuals are first divided into groups or categories and then independent samples within each group or stratum are selected (Blaklock, 1987). The fishers' associations (Beach Management Units) in Lake Victoria fishery, rice farmers' association (Mwea Irrigation Water Users Association), the group grazing ranchers' association (Naibunga Conservancy Trust) and organizations working with the fishers, rice farmers and group ranchers were the strata. Following Blacklock (1987), once the strata was obtained, a simple random sampling procedure was used to sample from the individual stratum.

3.8 The Sample

The sample in the three CPRs is as follows: (1) In Lake Victoria fishery, the sample comprised of Beach Management Units (BMUs) in Mbita and Suba Sub-counties of Homa Bay County and managers of organizations working with the fishers. Total sample number of BMUs selected for interview in Mbita Sub-County were 22 and in Mbita Sub-County 17. (2) In Laikipia group grazing ranches, the sample comprised of 9 group grazing ranches under the umbrella association Naibunga Conservancy Trust (NCT), in Mukogondo Division of Laikipia North District in Laikipia County and managers of organizations working with the group ranchers. (3) In Mwea Rice Irrigation Scheme, the sample comprised of the 11 Branch Canal Representatives of Mwea Irrigation Water Users Association (IWUA), the Manager of the Mwea National Irrigation Board and managers of organizations working with the rice farmers.

3.9 Description of Data Collection Instruments

Primary data was collected using structured interview guides addressed to the target population (as described above). Informal face-to-face discussions between the target population and the researcher and general observation of community behaviour by the researcher. The interview guide had three sections: section A sought respondents' background information, section B had items on management dynamics and section C governance structures. These instruments are chosen because they are easy to administer and given the low literacy levels of the leaders of the fishers, rice farmers and group grazing ranchers associations, they would be most effective in generating responses. Secondary data was sourced from Government of Kenya electronic data base - Kenya Open Data; Government of Kenya relevant documents that is, the Constitution, National Land Policy, Environmental Management and Coordination Act (1999), Community Based Organizations (CBOs), government organizations, ministries and agencies, educational and research

institutions, environmental conservation organizations, financial institutions, Media and telecommunication organizations, religious organizations, Non-Governmental Organizations (NGOs) and United Nations agencies operating in these counties. The researcher also sourced additional information from various publications by these organizations, their data bases and other literature on the economic, socio-cultural, political and environmental issues in CPR management.

3.10 Validity and Reliability of Data Collection Instruments

Validity refers to the ‘truthfulness’ of a measure. A valid measure of a concept is one that measures what it claims to measure (Shaughnessy and Pfannkuch, 2002). To ensure content validity of data collection instruments, the researcher consulted experts in Development, Environmental and Natural Resource Economics who reviewed the instruments. The experts examined the content of the instrument and indicated the degree to which it measured predetermined criteria; and judged the relative criticality of the various parts of the instrument. Methods have been developed to estimate reliability coefficients that measure the internal cohesion of a scale without necessitating any dividing or duplication of items. The Cronbach Alpha Coefficient was used on the pilot test results. This method measures the internal coherence of a scale that has been constructed from a group of items. The number of items initially contained in the scale is reduced according to the value of the coefficient alpha, to increase the reliability of the constructs measurement. The value of alpha varies between 0 and 1. The closer it is to 1, the stronger the cohesion of the scale (its reliability). Values closer to 0.7 are generally accepted (Thietart, 2001). An alpha of 0.8 was obtained for the pilot test and consequently the instruments were deemed reliable.

3.11 Description of Data Presentation and Analysis Procedures

Data collected was documented by compiling and presenting it in form of tables, figures and general descriptions. Analysis, discussion and synthesising entailed working through the data to arrive at a conclusion to answer the research questions and achieve the purpose of the study.

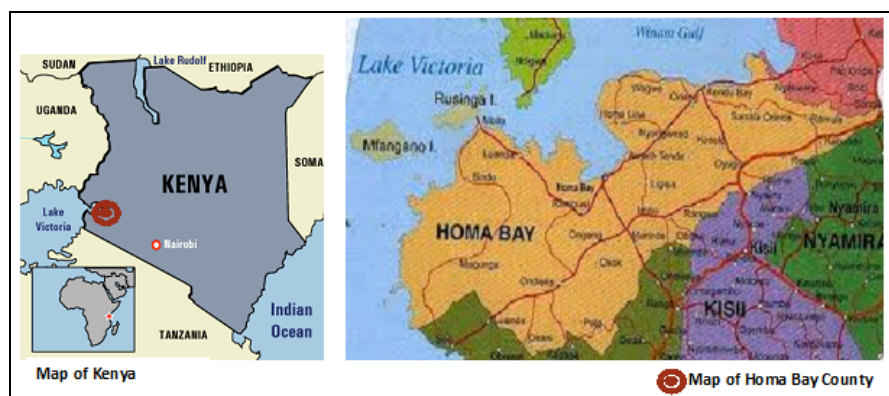
CHAPTER FOUR

THE CASE OF LAKE VICTORIA FISHERY

4.1 Introduction

This chapter outlines the case of Lake Victoria fishery based on the study's general objective which is to understand the evolution in management dynamics and operation of governance structures in large scale Common Property Resources (CPRs). The specific objectives are to: (1) Examine the evolution of management dynamics in the fishery overtime. (2) Examine the management model applied and its functioning the fishery. (3) Explore the governance structures and challenges of implementing them in the fishery. (4) Explore critical variables related to user groups, institutional arrangements and external environment in the fishery. (5) Suggest measures to improve the management and governance of the fishery.

Figure 4.1 Homa Bay County



Source: Google Maps

The study area is Lake Victoria fishery located in Homa Bay County in Nyanza Province specifically, the three districts of Homabay, Rachuonyo, and Suba. Lake Victoria stretches 412 kilometres from North to South, between latitudes 0°30'N and 3°12'S and 355 kilometres from West to East between longitudes 31°37'W and 34°53'E. The total county population is 963, 794 and covers an area of 3,183.3 square kilometres. It is situated at an altitude of 1,134 metres above sea level, has a volume of 2,760 km³ and an average and minimum depth of 40

and 80m respectively. It is the largest lake in Africa with a surface area of 68,800 km² and a catchment area of 193,000km². The lake contains numerous islands and a highly indented shoreline estimated to be 3,460 kilometres long. It surrounds groups of large islands such as, Sesse in Uganda, Ukerewe in Tanzania and Rusinga in Kenya. The Lakes flushing time (volume/average outflow is 138 years and its resident time is 21 years. The main rivers flowing into the lake are: (1) Mara, Kagera, Mirongo, Grumeti, Mbalageti, Simiyu and Mori from Tanzania. (2) Nzoia, Sio, Nyando, Kibos, Sondu-Miriu, Kuja, Migori, Riaria and Mawa from Kenya. (3) Kagera, Bukora, Katonga, and Sio from Uganda. The Nile River is the only surface outlet from the lake, with an outflow of 23.4 km³/per year (LVEMP, 2003).

The lake ecosystem (biophysical environment) has undergone substantial and alarming changes. Firstly, its *water quality*, as evidenced by massive toxic blue-green algae blooms, decline in food transparency, increase in water borne diseases, invasive water Hyacinth weed, overfishing, introduction of species (such as Nile Perch), increased nutrient input to the lake and oxygen depletion threat on artisanal fisheries and biodiversity - leading to eutrophication. Other threats to water quality include: (1) Intensive land use and increase in human and livestock populations along the lakeshores and islands. (2) Increased pollution from municipal and industrial discharges in rivers feeding the lake and in urban areas along the shorelines. (3) Increased nutrient flows are entering the lake from eroded sediments in the catchment, burning of wood fuels and from human and animal waste from surrounding areas. Sources of changes in the balance and nutrient load are pollution loading due to urban waste water and runoff, industrial activities, rivers, atmospheric nutrient deposition, nutrient mass and heavy metals and organics. (Kayambo & Jorgensen, 2006). Secondly, impacts of land use on pollutant loading.

The reason for choosing this county is because it contains almost 80 percent of Kenya's Lake Victoria waters and has a large endowment of fishery resources on which majority of local community are dependent upon for their livelihood. Fishing (on Lake Victoria) and agriculture are the main economic activities, accounting for the largest source of income in the county. Subsistence farming is practiced extensively with crops such as maize sorghum, ground nut, millet and potatoes being grown (Kenya Open Data, 2014). The outline of the chapter entails general descriptions of management and governance issues in the fishery as a CPR, background of the Lake Victoria fishery, data presentation, analysis and discussions, conclusion and recommendations.

4.2 Literature Review

Management in Fisheries

Human behaviour in the context of a fishery as a CPR, compounds physical uncertainty, thereby, creating complex situations for fishers to address. The reason is that more than a single or group of fishers' harvest fish from the resource consequently, fish stocks harvested by an individual are no longer available for others to harvest. Thus, the outcome of a single fisher's action is dependent not only on his/her own action, but on the actions of the other fishers using the same resource. The outcome is inefficient or suboptimal because fishers may use a variety of unregulated technologies or gear and interfere with each other as they harvest the fish. In addition, since different areas within a fishery are more productive than others, fishers compete for the best spots. In the process, destruction of gear occurs and physical violent conflicts arise among the fishers (Ostrom et al, 1994). Fisheries experience three CPR management dilemmas in form of (1) appropriation externalities, which arise because fishers are harvesting fish from a common stock, without considering the effects of their actions upon each other. (2) Technological externalities, which emerge when fishers physically interfere with each other in harvesting the fish, for example, gear conflicts or other forms of

physical interference which arise because fishers often find it advantageous to fish very close to one another. That is, gear is set so close together that the flow of fish among gear is obstructed, or if the fish population is highly concentrated, the efficiency of each boat may be lowered by congestion over the fishing grounds. (3) Assignment problems, which arise because fish is unevenly distributed across fishing grounds, and fishers in their uncoordinated choice of fishing spot, do not allocate themselves efficiently across spots. Consequently, problems arise over who should have access to the most productive spots and how access should be determined (Ostrom et al, 1994).

In the context of the physical environments in fisheries, appropriation, technological and assignment problems vary in their complexity and this in turn affects the likelihood of fishers designing and developing governance structures to address specific problems. If, however, the dilemmas meet three criteria, they can be solved. First, repeated encounters under similar circumstances in which opportunistic individual behaviour is seen to destroy the possibilities for collective gain. Second, an information network - arising from trading, competition, or other instructions - that forms the basis for the identification and negotiation of possible rules. Third, a collective means for the enforcement of these rules (Wilson (1982).

Generally, fisheries co-management is an arrangement in which responsibilities and obligations for sustainable fisheries management are negotiated, shared and delegated among government, fishers and other interest groups and stakeholders (Pomeroy & Rivera-Guieb, 2006). Njaya (2007), observes that many co-management in Africa are mainly consultative, meaning that mechanisms exist for government to consult with fishers, but all decisions are taken by government; and partnerships therefore, tend to be unequal. This is also the situation in Lake Victoria; and it is not clear if a consultative partnership can expect the consulted party to implement non-negotiated decisions voluntarily when these are not agreed upon

(Welcomme and Halls, 2014). The management institutions around Lake Victoria have called for drastic interventions to ensure that the current gear and mesh regulations are enforced under the recently initiated 'Operation Save the Nile Perch' coordinated by LVFO. The question according to Welcomme and Halls (2014), is whether the stocks are currently in such bad state that time has run out for negotiations on management issues instead of top-down enforcement.

A study by Joost (2013), looks at the social practices of Nile Perch fishers, uncovering the operation of different, spatially situated, fishing styles. It concludes that these styles structure the social relations that fishers mobilise, symbolic meanings they attach to their gear and values that inspire their decision making. That differences in fishing styles foster small-scale fishers' socialization social networks, their use of different gears and the expectations they carry into the fishing business; thus, impacting on the spatial organization of the fishery. Andrew and others (2009), in their study considers the role of ecological processes and complimentary perspective for conservation arising from an emphasis on process. It identifies ecological processes that sustain biodiversity as climate processes, primary productivity, hydrological processes, formation of biophysical habits, interactions between species, movements of organisms and natural disturbance regimes. It concludes that Anthropogenic threats to conservation exert their influence by modifying or disrupting processes. That long-term conservation of biodiversity and the well-being of human society depend on both protection of natural assets and maintaining the integrity of the ecological processes that sustain them.

In the case of Lake Victoria fishery, due to the physical complexity in terms of geographical size, subtractability of fish stocks harvested by a fisher and the uneven distribution of fish stocks across fishing grounds; fishers are faced with various appropriation, technological and

assignment externalities or problems. However, fishers can solve them because they have been sensitized on the need to come together through Beach Management Units (BMUs). They can regulate behaviour through collective action, collaborate with other stakeholders in the fishery to develop and design governance structures and adopt efficient management models and with government support BMUs can therefore effectively enforce and monitor these governance structures.

Governance in Fisheries

Fishers design and develop governance structures to coordinate their use of shared fishing grounds and overcome appropriation, technological and assignment problems. Operational rules such as, boundary, choice or authority rules specify what is allowed, required and forbidden in making day-to-day operational decisions; while collective-choice rules specify the terms and conditions for interpreting, enforcing, and altering operational rules in the system (Ostrom et al, 1994). These governance structures include: (1) Position rules which specify the set of positions: appropriator - a fisher and member of fishers' association, officials of the association and member of a tribunal (to advocate disputes over appropriation and provision). (2) Boundary rules which define how participants enter or leave these positions: local - resident of the area, use of a particular technology, fishing license, ownership of limited property related to fish harvesting (that is fishing berths), lottery (to allocate random fishing spots), clan (specify fishing spots based on clans), registration on eligibility list to participate in lottery, continuing usage of access rights, ethnicity or tribe (local) and ownership or leasing of land in the area. (3) Choice or authority rules which specify the set of actions: lease of rights - to or from holder of usage rights, lease of land in the area, delegation of provision to third party and rules of the association specify the next actions to be taken in case of rule violation.(4) Aggregation rules which specify the transformation function: agreement on technology (gear) to be used, collective-action rules

proportional to usage rights, define the eligibility to participate in lottery and determine the procedure of changing association rules. (5) Information rules which specify information available: standardized measurement of appropriations, reporting of illegal appropriation (fishing) to higher authority, reporting of provision levels and rules that specify how information is disseminated. (6) Payoff rules which specify how benefits and costs are required, permitted or forbidden: setting the license fees, fixed penalty for unreported appropriation (fishing) and fees for ownership of excess property related to fish harvesting. (7) Scope rules which specify the set of outcomes: harvest from a specific location, harvest fish of a specific size, fixed-time slots (limits the amount of time that a fishing gear can remain on a choice fishing spot) and fixed-orders (in terms of seasons or fishers to take turns in accessing spot) (Ostrom et al, 1994).

Fishers are less likely to engage in institutional change or device arrangements (such as individual transferable quotas), in efforts to directly resolve appropriation externality resulting from the nature of fish stocks. Fishers harvest from multiple stocks whose populations fluctuate unpredictably and whose dynamics are not well understood. Thus, fishers cannot determine with precision whether a decrease in the fish population is because of harvesting, environmental circumstances, or both (Dickie, 1979; Wilson, 1982). Due to lack of this information, it is also difficult to determine how many fish constitute the stock, how many are withdrawn, and therefore, the effect that each fisher's catch has on the catches of other fishers. This problem is further compounded by the fact that most communities of fishers often harvest from the same stocks of fish; and the solution requires that fishers determine the costs generated by all other fishers utilizing the common stock and coordinate their activities. Under these circumstances therefore, enforcement of agreements is difficult and sometimes impossible (Dickie, 1979; Wilson, 1982). Technological externalities are more likely to be solved because both direct and indirect gear interferences are immediately

noticeable and its causes understood; consequently, fishers may realize the effects upon their catches of fish when other fishers set their gear too close to theirs. Thus, fishers can use this knowledge to develop alternative set of rules to address these problems (Martin, 1979; Raychandhuri, 1980; Shortfall, 1973). Since technological externalities arise within a single ‘information network’ of fishers utilizing common grounds within a finite space, the effects are localized to a few or group of fishers. The type of behaviour on which rules focus, the design of the rules used, and ability of fishers to monitor affects the costliness of monitoring, as a by-product of harvesting fish. Thus, rules that constrain the type of gear that may be used and spacing of the gear, are also easy to monitor (Cordell, 1972; Davis, 1984). Assignment problems are more likely to be solved by fishers because areas and spots of fishing grounds remain stable over time and choice fishing spots also remain stable, which allows fishers to determine their location. As fishers compete to gain the best spots, conflicts arise which make fishers aware that opportunistic individual behaviour results in suboptimal or inefficient outcomes. It is easier and less costly to monitor and enforce rules to allocate spots for a specified period (Ostrom et al, 1994). Thus, to resolve appropriation, technological and assignment problems, fishers in Lake Victoria fishery have devised governance structures to regulate resource use through monitoring, enforcement and sanctions. This is done through collaboration among the fishers, BMUs and other stakeholders who have diverse roles and interests in the fishery.

Bromley (2009), argues that the imperilled status of global fish stocks is evidence of national governments to provide effective management to protect those stocks. The universal policy intervention is to a grant the commercial fishing sector permanent endowments of income and wealth through Individual Transferable Quotas (ITQs). Thus, the fishing industry is entrusted to be stewards, efficient, maximise resource rent, stop competing for fish stocks and maximise social welfare. Unfortunately, incoherent models from fisheries economics render

these promises false as they are confused about the essential concepts of: efficiency, economic rent, resource rent, Ricardian rent, average costs and revenue among firms and industry, extra-normal profits, stewardship, property, rights, privileges and property rights. The consequence of this spurious and misguided application of ITQs compounds the tragedies of past malfeasance by the dangerous endorsement of this bundle of confusions, contrivances and deceptions (Bromley, 2009).

4.3 Biophysical and Community Attributes of Lake Victoria Fishery

Lake Victoria stretches 412 kilometres from North to South, between latitudes 0°30'N and 3°12'S and 355 kilometres from West to East between longitudes 31°37'W and 34°53'E. It is situated at altitude of 1,134 metres above sea level, has a volume of 2,760 km³ and an average and minimum depth of 40 metres and 80 metres respectively (Kayombo & Jorgensen, 2006). According to the East African Community's (EAC) Lake Victoria Basin Commission (LVBC) of 2007-2010, Lake Victoria, with a surface area of 68,870 square kilometres, is Africa's largest and world's second largest freshwater lake. The lake is considered as one of the most important shared natural resource by partner states of Eastern Africa. Its catchment area covers an area of 193,000 square kilometres with Tanzania occupying 44 per cent, Kenya 22 per cent, Uganda 16 per cent, Rwanda 11 per cent and Burundi 7 per cent (LVBC, 2014). It contains numerous small and large islands such as Sesse, Ukerere and Mori and has a highly indented shoreline estimated to be 3,460 kilometres long. The lake's flushing time (volume/average outflow) is 138 years and its residence time (defined as the amount of water in the lake divided by either the rate of addition of water to the lake or the rate of loss from it) is 21 years. The main rivers flowing into the lake are: (1) Mara, Kagera, Mirongo, Grumeti, Mbalageti, Simiyu and Mori from Tanzania. (2) Nzoia, Sio, Nyando, Kibos, Sondu-Miriu, Kuja, Migori, Riarua and Mawa from Kenya. (3) Kagera, Bukora, Katonga and Sio from Uganda (LVEMP, 2003).

Lake Victoria ecosystem has undergone substantial and alarming changes. First, in terms of water quality as evident in massive toxic Blue-Green Algae blooms, decline in lake transparency and increase in water borne diseases. Secondly, impacts of land use on pollutant loading, which include lack of perennial cover and run off control, soil erosion and high sedimentation. Thirdly, freshwater wetlands in the lake basin which constitute an important resource base in terms of food production, hydrological stability and ecological productivity. These wetlands are being depleted and degraded as they are put into intensive cultivation of crops or used for waste water and garbage discharges or deforested for wood fuel and craft products. Fourthly, invasive aquatic weeds specifically, the Water Hyacinth which invaded the lake in 1989 and has caused significant socioeconomic and environmental impacts. These include impeded transport of irrigation and drainage water in canals and ditches, hindered navigation, interference with hydropower schemes, increased sedimentation by trapping silt particles, decreased human food production in aquatic habitat (fisheries and crops), decreased possibilities for washing and bathing and adversely affecting recreation (swimming). Other impacts are hindered processing and delivery of municipal and industrial water supplies, harbouring venomous snakes, transformation of aquatic habitats into wetlands or into terrestrial through succession by other plant species, disappearance of flora and fauna unable to compete or survive in infested environments, reduced lake levels because of water loss and provides a conducive habitat for disease vectors for Malaria, Encephalitis, and Filariasis. Positive impacts include pollution abatement due to its capacity to absorb heavy metals and phenols, increased fish diversity with some of the species that had disappeared reappearing in fish catches and provides refuge for, breeding and feeding areas and reduces fishing activities. Lastly, the lake's biodiversity was originally a multi-species fishery, with a diverse fish fauna, comprising 28 genera and 350 species. In the late 1950s, Nile Perch and non-indigenous Tilapia were introduced into the lake with the aim of improving the declining

indigenous stocks and removing the ‘trash fish’ (Haplochromines) considered of little value to humans. Today, as many as 200 species of fish have disappeared, due partly to the introduction of Nile Perch which eats the smaller fish species. Eutrophication has also made the benthic waters inhabitable to fish (Kayombo & Jorgensen, 2006).

The lake is a major source of water and fisheries in the region. The socio-economic importance of Lake Victoria to the Eastern Africa region is associated with the fact that it is: the largest inland water fishing sanctuary, a major inland transport linkage to the East African countries, a source of water for domestic, industrial and commercial purposes, a major reservoir for hydroelectric power generation, a major climate modulator in the region and a rich biodiversity. The fisheries of Lake Victoria provide an immense source of income, employment, food and foreign exchange for Eastern Africa. The Lake produces a fish catch of over 800,000 tonnes of fish annually, currently worth about US\$ 590 million of which US\$ 340 million is generated at the shore and a further US\$ 250 million a year earned in exports from the Nile Perch fishery. The fisheries support over 2 million people in terms of household incomes and meet the annual fish consumption needs of almost of 22 million people in the region (LVFO, 2014).

In 1994, the Lake Victoria Fisheries Organization (LVFO) was formed through a convention signed by the East African Community Partner States of Kenya, Tanzania and Uganda because of the need to manage the fisheries resources in Lake Victoria in a coordinated manner. LVFO implemented co-management on Lake Victoria and member states legally empowering fishing communities to become equal and active partners with the government in fisheries management and development. The fishing communities are organized through the formation of legally empowered Beach Management Units (BMUs) and though currently they are not formally part of LVFO structure, the plan is to integrate them in future (LVFO,

2014). The BMUs are the foundation of fisheries co-management and are community-based organizations that bring together everyone involved in fisheries at a beach (boat owners, crew, builders, retailers and repairers, traders, processors, net retailers and repairers) to work with government and other stakeholders in managing fisheries resources and improving the livelihoods of the community members. Through LVFO's Fisheries Management Plan (FMP) the BMUs are being reformed to become more inclusive and effective. The BMUs now have legal status, giving legal power to BMU activities and all stakeholder groups are involved as registered members of a BMU. At least 30 boats are required to plan, raise revenue and operate effectively and more than one landing site. A committee with representatives from all stakeholder groups including at least 3 are women and an assembly formed by all registered members of the BMU, who meet at least once every three months and oversee the work of the committee. The large scale of Lake Victoria fishery is manifested in terms of: (1) Geographical size, Kenya's Lake surface area is 4,080 square kilometres, of which 3,264 square kilometres (80%) is in Homa Bay County, in addition to a dry land cover of area of 3,183.3 square kilometres. (2) The number of users (fishers), Homa Bay County has a population of 963,794. In the entire Lake Victoria fishery, there are 1, 087 Beach Management Units (BMUs) with each having a membership range of 40 to 600. Approximately 124,369 fishers use and depend on the Lake Victoria fishery, with 33,037 fishers in Kenya (Kenya Open Data, 2014).

4.4 Methodology

The study adopts a Qualitative Research (QR) methodology and uses a survey research design at a group level which in this case are the fishers, who are members of the local fishing community in the lakeside area of Homa Bay County. They reside therein, and enjoy all property rights in the Lake Victoria fishery. The target population comprise (1) officials of various Beach Management Units in Lake Victoria fishery in Homa Bay County. (2)

representatives of Community Based Organizations (CBOs), government organizations, ministries and agencies, educational and research institutions, environmental conservation organizations, financial institutions, media and telecommunication organizations religious organizations, Non-Governmental Organizations (NGOs) and United Nations agencies operating in Homa Bay County working with the fishing community. The sampling process involved identifying the fishers' associations (BMUs) and specific organizations working in Lake Victoria fishery. Primary data was collected using structured interview guides addressed to the target population, informal face-to-face discussions between the target population and the researcher and general observation of community behaviour by the researcher. Secondary data was sourced from Government of Kenya electronic data base - Kenya Open Data, Government of Kenya relevant documents that is, the Constitution, National Land Policy, and the Environmental Management and Coordination Act (EMCA), 1999. The researcher also sourced additional information from various publications by the above organizations, their data bases and other literature on the economic, socio-cultural, political and environmental issues in CPR management.

4.5 Data Presentation, Analysis and Discussion

Total Sample

The total sample number selected for interview in Tables 4.1, 4.2a and 4.2b comprised of 22 BMUs in Mbita, Lambwe and Mfangano divisions in Mbita Sub-County; 17 BMUs in Central and Gwassu divisions in Suba Sub-counties of Homa Bay County; 20 fishers; and 1 representative from: Department of Fisheries, Public Health Office, Kenya Police Department, District Technical Staff, National Environmental Management Authority, Lake Victoria Fisheries Organization, Lake Victoria Basin Commission, African Medical Research Foundation (AMREF), International Centre of Insect Physiology and Ecology (ICIPE), Samaki-Net, CRADLE-Children Foundation and International Medical Corps. Fish species in

these beaches are of three types Nile Perch, Tilapia, and Omena. Nile Perch species constitute the largest fish stock in the fishery (55.1%), followed by Tilapia (29%) and then Omena (15.9%).

Table 4.1: Total Sample

Respondent	Number
BMUs	39
Fishers	20
Department of Fisheries	1
Public Health Office	1
Kenya Police Department	1
District Technical Staff	1
NEMA	1
LVFO	1
LVBC	1
AMREF	1
ICIPE	1
Samaki-Net	1
CRADLE-Children Foundation	1
International Medical Corps	1

Table 4.2a: BMUs in Suba Sub-County

Location/Division	Beach/Landing Site	Fish Species	Number of Members
Central	Gingo	Nile Perch/Omena	57
	Sindo Main	Nile Perch	250
	Kibuogi Island	Nile Perch	178
	Kosodo	Nile Perch	164
	Rangwe/Konyango	Nile Perch/Omena	352
Gwasssi	Litare	Nile Perch/Omena	232
	Nyagwethe/Komogo	Nile Perch	106
	Utere/Kadori	Nile Perch	292
	Kiriwo/Ruacha	Nile Perch	160
	Osiri	Nile Perch/Omena	404
	Kisegi	Nile Perch/Omena	245
	Kinda	Nile Perch/Omena	244
	Kiwa 'A'	Nile Perch/Omena	508
	Kiwa 'B'	Nile Perch	588
	Mukuyu	Nile Perch/Omena	184
	Kagoro	Nile Perch	425

Table 4.2b: BMUs in Mbita Sub-County

Location/Division	Beach/Landing Site	Fish Species	Number of Members
Mbita	Gode Ariyo	Nile Perch & Tilapia	141
	Ulugi	Nile Perch	138
	Ngothe	Nile Perch	70
	Kaugege	Omena	224
	Sieng'a	Nile Perch & Tilapia	83
	Nyaroga	Nile Perch & Tilapia	41
	Sukru	Omena	348
	Misori Kobar	Nile Perch & Tilapia	118
	Ondago	Nile Perch & Tilapia	55
	Wakondo	Nile Perch & Tilapia	55
Lambwe	Alii	Nile Perch & Tilapia	133
	Ndhuru	Tilapia	132
	Kisaka	Nile Perch & Tilapia	134
Mfangano	Makira	Nile Perch	160
	Nyakweri	Nile Perch	426
	Kitenyi	Nile Perch	144
	Mauta	Omena	128
	Mrongo	Nile Perch & Omena	198
	Yokia	Nile Perch & Omena	316
	Wakula	Nile Perch & Omena	134
	Kasarani	Nile Perch & Omena	128
	Sena	Nile Perch	252

The Structure of the Beach Management Unit

A BMU is made up of: (1) BMU Assembly constituted by boat owner, crew members, supervisors, chatterers, artisanal fish processors and traders, fishing gear and equipment dealers, boat makers, agents of fish processors and other fish related institutions operating in the beach. (2) BMU Committee, which comprise of 9-15 members democratically elected by the BMU Assembly. The committee consists of the Chairperson, Vice Chairperson, Secretary and Treasurer, plus any other post defined by National Guidelines or the BMU Assembly. Sub-Committees to be headed by members of the main committee may be formed as need

arises and depending on the by-laws of the BMU. (3) The representation of the BMU Committee should be as close as possible to the following distribution: 30% boat owners, 30% crew (fishing labourers/barias who do not own boats), 30% of other stakeholder groups (including fish processors, boat makers, local gear makers/repairers, fishing equipment dealers/managers) and 10% fish mongers/traders. (4) Funding of BMU activities comes from various sources such as, membership fee as approved by the BMU Assembly where a country operates a fishing tendering system, BMUs may compete for such tenders; service charges on the use of BMU assets, landing site user fees, fines levied for infringement of by-laws and establishment of micro-projects, for example, transport of cargo/passengers or fishing project for income generation.

Requirements for membership to the Beach Management Unit

(1) A person must register him/herself and be vetted by the local authority/fisheries officer at inception having fulfilled the stakeholder criteria: boat owners, crew members, supervisors, chatterers, artisanal fish processors and traders, fishing gear and equipment dealers, boat makers, agents of fish processors and other fish related institutions operating in the beach. (2) Non-citizens should be in possession of a valid work permit provided by the Immigration Department and must comply with requirements for non-citizens in the National Fisheries Act: Chapter 378 before they apply for membership of BMUs.

Role of BMUs in Lake Victoria fishery

The BMU Assembly elects, approves and removes BMU Committee members and approves the BMU management and development plans, budgets, audited accounts and by-laws. The BMU Committee maintains and keeps a register of all boat owners, fishing equipment, fishers and BMU members. Identifies markings of fishing gears and outboard engines for licensed fishers, vets boat owners and fishers for licensing and ensures that licenses are

issued to those registered with the BMU. Proposes and enforces by-laws endorsed by County Authorities and identifies fish breeding areas and demarcates prohibited fishing zones. Undertakes monitoring, control and surveillance, assists in data collection for Frame Surveys, catch monitoring and socio-economic investigations and inspects and records visiting boats and gives permission to land. Improves sanitation and hygiene at landing sites, networks with other BMUs to ensure marketing and fair pricing of fish and fish products and ensures that the BMU forms part of the development organ in their areas of jurisdiction. Prepares annual work plans, budgets and formulates funding proposals and financial reports. BMUs other informal roles include: solving conflicts among fishers, members of the community and families. Sensitize the local fishing community on current social, economic, political, cultural and environmental issues. Acts as guarantor for fishers to acquire financial and physical assets and oversees payment of fines and disciplines defaulters of BMU by-laws. Organizes clean-up activities at the beaches, recreational activities for the local fishing communities, encourages the local fishing community to engage in agricultural activities and oversees the fishers' welfare associations and sub-committees.

The BMU Assembly as the supreme organ of the BMU is empowered to carry out its role in the fishery. The BMU Committee collaborates with the central and local government authorities, gets approval from the Assembly and relies on indigenous knowledge to perform its role. In addition, BMUs organize and encourage the fishing community to participate in other economic, social and environmental activities in collaboration with respective organizations and institutions. For example, livestock, food crops and horticultural agriculture, sports tournaments, cultural and traditional dances, art displays and open-air educative film screening, financial support for purchase of fishing gear and emergency expenditures (medical and funeral) and education bursaries and scholarships.

Other Stakeholders, their Role and Interest in the Lake Victoria fishery

The BMU Committee in performing its functions consults and cooperates with local (now County) government, relevant agencies of central government and lead agencies. They include:

The Lake Victoria Fisheries Organization

Harmonizes, develops and adopts conservation and management measures for sustainable utilization of living resources of Lake Victoria to optimize socio-economic benefits from the Basin Partner States.

Lake Victoria Basin Organization

Responsible for coordinating the sustainable development agenda of the Lake Victoria Basin through harmonization of policies, laws, regulations and standards. Promotes stakeholders' participation in the sustainable development of natural resources. Gives guidance on implementing sectoral projects and programs, promotion of capacity building and institutional development and security and safety on Lake Victoria. Promotes research and development, monitoring, evaluation and compliance with policies and agreed upon actions. Prepares and harmonizes the Member States' negotiating positions against any other state on matters concerning the Lake Victoria Basin. Receives and considers reports from the Member States' institutions on their activities relating to the management of the Basin under the LVBC Protocol. Initiates and promotes programs that target poverty eradication and performance of any other functions that may be conferred upon it under the LVBC Protocol.

Department of Fisheries

Vested with the overall responsibility for the fishery administration of formulating policy and issue guidelines on fisheries legislation and enforcement. Provides technical assistance for fisheries development to various stakeholders. Sets standards and guidelines on fish quality

and safety and designs fisheries information collection systems for implementation. Issues registration certificates to BMUs and monitors their performance and mobilizes donor support for development projects.

Local or County Authorities and District Technical Staff

Implements national fisheries policies and enforces fisheries laws and regulations. Produces development plans, accesses central government grants to support capture fisheries and post-harvest fisheries sector. Assists in conflicts resolution among fishers and lower level co-management institutions and supports development of BMUs through awareness raising and training programs. Develops and implements fisheries management plans, approves and implements BMU guidelines, by-laws and other ordinances and monitors and evaluates the performance of the BMUs.

Scientific Committee and Fisheries Research Institutes

Disseminates research results to guide development of fisheries management strategies. Develops appropriate technologies for sustainable fisheries management and appropriate control measures for invasive aquatic weeds. Provides information to guide co-management and socio-economic development of the fishing communities.

Academic Institutions, Private Sector and Non-Governmental Organizations,

Community Based Organizations and other Lead Agencies

Deals with issues such as, health, advocacy, environment, water resources, wildlife and wetlands. Trains BMUs and local government officials and participates in co-management activities at all levels. Disseminates information on co-management and fisheries technologies. Assists fishing communities in developing their savings capacity and development of alternative income generating activities within fishing communities. Provides rural development services and amenities. Advocates for fisheries stakeholders' rights and

positively influence national policies and laws, against child-labour in the fishery and for control of HIV/AIDS and other STDs within fishing communities.

Development Partners, International Organizations, Donors and Collaborators

Advices government and BMUs on long-term development strategies. Assists government in capacity building of BMUs. Supports and strengthens NGOs in fisheries management, development and relations among border fishing communities. Provides additional resources for implementation of management plans and programs.

For effective and harmonious participation of these stakeholders in Lake Victoria fishery co-management, each party must understand its own role, those of others and the relationship and links among them. The relationships established among different sets of stakeholders, has created new opportunities for both competition and cooperation and for exercise of control and resistance. Consequently, this ensures that stakeholders have both shared and competing interests; and each of them can avoid its agents being corrupted or have its interests captured by another. In addition, this has ensured efficiency in the management of the CPR, by state agencies gathering, analysing and using information about the status of the resource system; all parties negotiating shares and general parameters of regulatory measures; all parties developing specific regulations to govern harvesting of shares; and communities bearing the responsibility for implementing and enforcing governing regulations.

The other stakeholders who have interests in the Lake Victoria fishery are focused on fulfilling their specific mandates and are not directly involved in its management and governance. For example, Public Health officers handle health and sanitation matters, CRADLE-Children Foundation focuses on children rights and child labour. Although the National Environment and Management Authority is to ensure environmental sustainability, they are also not able to effectively do this due to what their respondent termed as

“institutional rigidities” and lack of field personnel. Fishers expressed gratitude to CRADLE-Children Foundation for their intervention services in curbing child-labour in the fishing industry, which has had very negative impact on schooling, health and general child welfare. AMREF and International Medical Corps also received accolades from the fishers for the HIV/AIDs services and support they give to the fishing community in Homa Bay County which has the highest infection and prevalence rates in Kenya (LVBC, 2014).

Governance Structures used by Fishers in Lake Victoria Fishery

The LVFO set up the Fisheries co-management working group, mandated to develop and design BMU Guidelines which make up the governance structures (rules and norms) and by-laws for fishers. These are indicated in Table 4.3 below.

Table 4.3: Governance Structures

	BMU	BMU%	DoF
Position rules			
A fisher should be a member of a fishers' association	39	100	1
Appointment of officials of the fishers' association	39	100	1
Appointment of a tribunal to settle disputes among fishers	39	100	1
Boundary rules			
A fisher is required to be a resident within the area	39	100	1
A fisher must use a certain technology or fishing gear	39	100	1
A fisher must pay for a fishing license	39	100	1
A fisher must own limited property related to fishing (berths)	0	0	0
Use of lottery (lots) to allocate random fishing spots to fishers	0	0	0
Allocate fishing spots based on a fisher's clan or ethnicity	0	0	0
A fisher to register to participate in lottery	39	100	1
A fisher to have continuing usage rights to Lake Victoria fishery	39	100	1
A fisher must belong to a local clan or ethnicity	39	100	1
A fisher must own or lease land in the area	0	0	0
Choice or authority rules			
Specifies to or from whom a fisher can lease fishing rights	0	0	0
Specifies who can lease land in the area	0	0	0
A fisher can ask someone else to perform maintenance tasks in Lake Victoria fishery on their behalf	16	41	1
Specific actions to be taken in case a fisher violates an agreed upon rule	22	56	1
Aggregation rules			
Agreement on technology or fishing gear to be used	39	100	1
Agreement on maintenance services a fisher must perform for management of Lake Victoria fishery	9	23	1
Defined requirements to participate in lottery to allocate fishing spots	0	0	0
Set procedure for changing fisher's association rules	0	0	0
Agreement on regulated landing of fish and management of sites (beaches)	39	100	1
Agreement on introduction into, harvesting or removal from the fishery any aquatic plants	32	82	1
Information rules			
Set quantity of fish a fisher can harvest per given period	0	0	0
A fisher is required to report any illegal fishing observed to higher authority	9	23	1
A fisher to report maintenance services they perform towards the management of Lake Victoria fishery	9	23	1
Set procedures of passing all important information to fishers	39	100	1
Fixed penalty fees for unreported fishing in Lake Victoria fishery	9	23	1
Scope rules			
A fisher should fish from a specific location	39	100	1
A fisher should harvest fish of a specific size	39	100	1
A fixed time that a fishing gear can remain on a choice fishing spot	0	0	0
Fixed-orders that require fishers to take turns in accessing fishing spots	0	0	0
Fixed-orders that requires fishers to harvest fish only in specific seasons	39	100	1
Fixed-orders that require fishers to harvest away from their breeding areas/sections	39	100	1
A fisher should not harvest a prohibited/endangered species of fish	39	100	1

According to the respondents, position, boundary, pay-off and scope rules are the most used in Lake Victoria fishery (39/39 or 100%). The reason being that they ensure fishers

participate fully in the management and governance of the fishery, restrict entry into the fishery of non-members of the BMUs; various fees charged and regulation of fishing activities in terms of fish size, breeding seasons and prohibited fish species. Boundary rules that relate to ownership of limited property such as berths, use of lottery (lots) to allocate random fishing spots to fishers, allocate fishing spots based on a fisher's ethnicity or clan and a fisher to own or lease land in the area have a 0/39 or 0% response because they are not applied in the Lake Victoria fishery. The reason is that the beach is already a predetermined area of operation for BMUs and only members can fish and land there. Thus, there is no need to apply these rules because by being residents in the area and members of specific BMU, fishers have all rights of access and withdrawal in the lake. Choice or authority rules that specify from whom a fisher can lease land in the area have a 0/39 or 0% response because this is not applicable in the BMU Harmonized Guidelines. Only residents in the geographical location (beach) have land rights and cannot lease their land to 'outsiders'. However, a fisher can pay someone else to perform maintenance tasks in the fishery on their behalf and there are specific actions to be taken in case a fisher violates an agreed upon rule.

Agreement on technology or fishing gear to be used, regulated landing of fish and management of landing sites (beaches) and introduction into, harvesting or removal from the fishery any aquatic plants are well known and applicable to fishers 39/39 or 100%. Aggregation rules which require fishers to know the approved fishing technology and gear, maintenance services required and harvesting of aquatic plants are at 32/39 or 82%. Aggregation rules that define requirements to participate in lottery to allocate fishing spots and set procedures for changing fishers' association rules are 0/39 or 0%, because as indicated above, all fishers residing within a beach automatically qualify to fish in any spot and to participate in changing fishers' association (BMU) rules.

Choice or authority rules which require that a fisher performs maintenance tasks and actions to be taken against a rule defaulter are at 22/39 or 56% followed by information rules at 9/39 or 23% which focus on record keeping of maintenance tasks and observed illegal fishing and how important information is disseminated to fishers. Information rule to set the quantity of fish a fisher can harvest per period is not applicable 0/39 or 0% because once fishers go fishing out into the lake, it is not possible to monitor and record their activities in terms of fish stocks harvested. Instead, the fish catch depends on pure 'luck' of the fisher and fishing gear used. Recording of any illegal fishing observed to higher authority and maintenance services performed are not commonly applied because as mentioned above, most of the fishing is done at night and only patrol guards can monitor such activities and BMU officials are the ones who keep maintenance services records. Fishers are aware of and use pay-off rules 39/39 or 100% but only a few 9/39 or 23% use fixed penalty fees charges for unreported fishing because individual fishers do not undertake monitoring of other fishers' activities while out fishing. Scope rules are widely used 39/39 or 100% however those that require a fixed time that a fishing gear can remain on a choice fishing spot and fixed orders to take turns in accessing fishing spots are not applicable because. Fishers are free to stay at a fishing spot simultaneously and if they want without any time limits. This is shown in Table 4.3 above and figures 4.2, 4.3 and 4.4 below respectively.

Figure 4.2: Aggregation rules

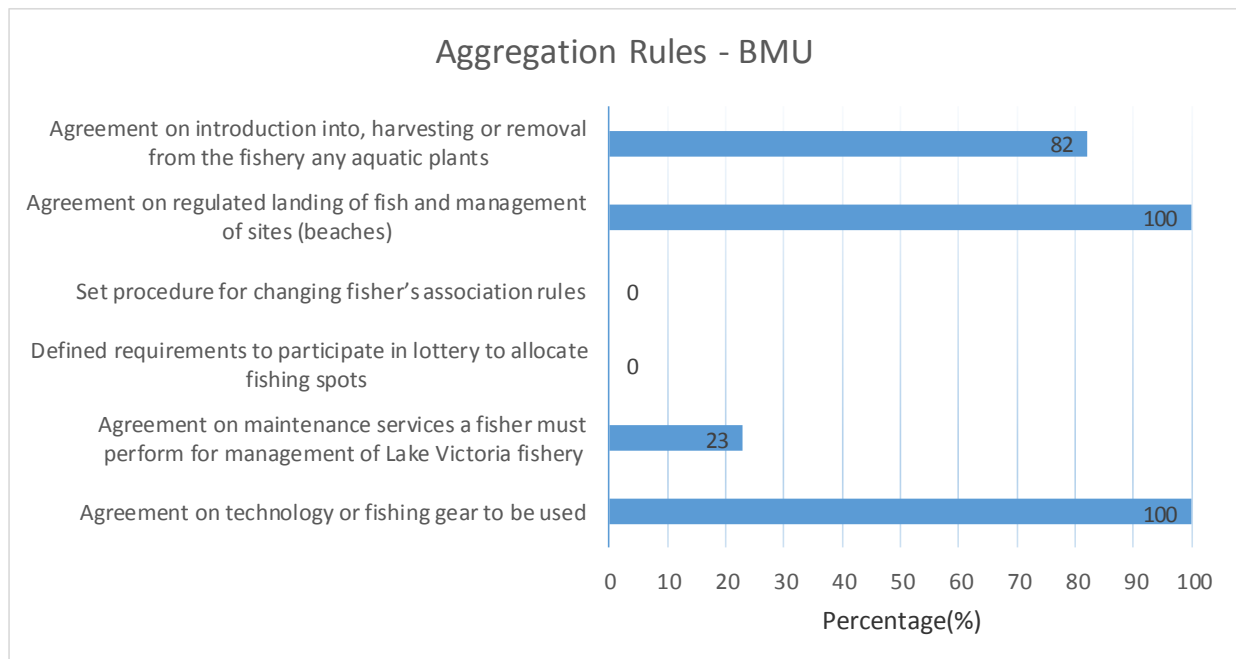


Figure 4.3: Choice/authority rules

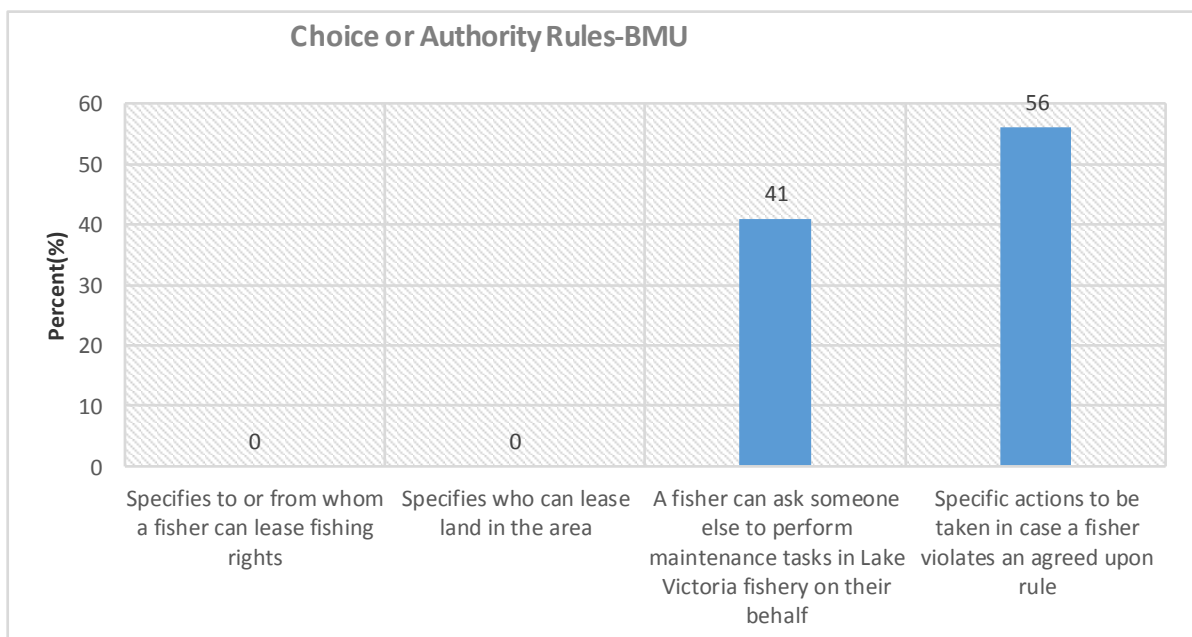
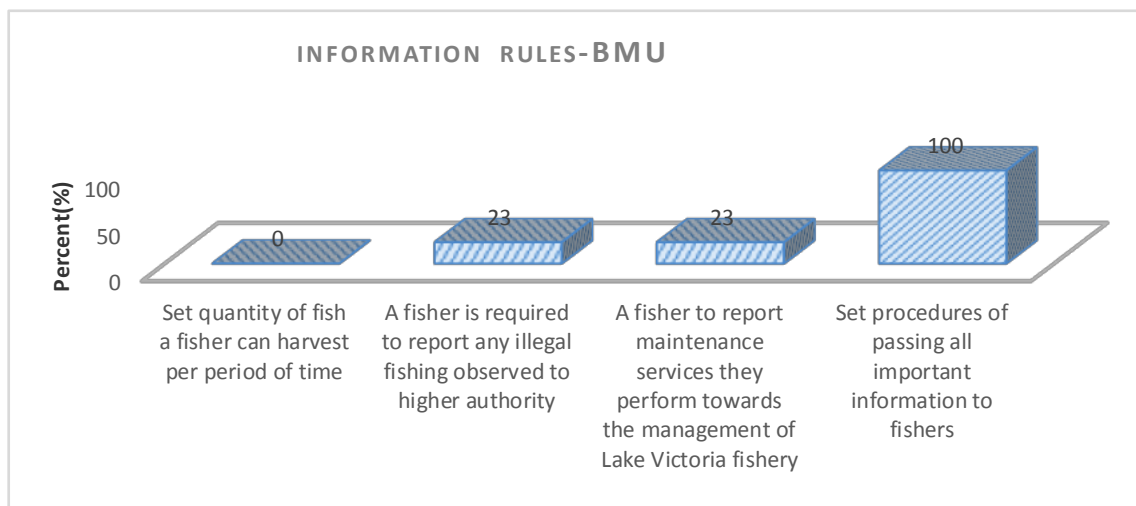


Figure 4.4: Information rules



Phases in Governance Structures

Governance structures in Lake Victoria fisheries are intended to promote the empowerment and active participation of stakeholders at all levels in fisheries governance. That is, they define how, through creation and development of BMUs, fishers can directly manage their own affairs and be actively involved in the formulation and implementation of fisheries development plans that affect them. The process takes various stages with different stakeholders as shown in Table 4.4 below.

Table 4.4: Phases in governance rules

Development and designing

Review of the status of BMUs and co-management institutions in Partner States
Develop guidelines for establishment and operation of BMUs (organs, functions and members)
Propose participation mechanisms for capacity building of BMUs
Coordinate the establishment of co-management institutions
Determine the different institutions to be included in the co-management
Mobilize, sensitize and train the fishing community in co-management
Develop modalities for funding BMU activities and co-management institutions
Propose mechanisms for monitoring, evaluation of co-management operations, impacts and documentation

Implementation

Awareness creation of political and technical officials
Training of change agents
Awareness creation of communities
Identification of landing sites for BMU formation
Registration of BMU members
Decision on number of BMU Committee members and posts
Nomination procedures for BMU Committee members
Election of BMU Committee members
Formulation of BMU rules of procedure (specific by-laws)
Taking oath (before a magistrate in the presence of the Chief Administration Officer or his/her representative)
BMU capacity building in collaboration with the Fisheries Department

Monitoring and enforcing

Prohibited methods of fishing
Obstructing authorized officers
Disqualification of a BMU member
Stealing fishing gear

Sanctioning and arbitration

Those who break rules or norms are liable to a fine or imprisonment or both

In view of the importance of accelerating the speed of establishing a network of BMUs around Lake Victoria and of benefits of lesson sharing and greater harmonization of procedures, the LVFO set up the Fisheries Co-Management Working Group mandated to develop and design Harmonized BMU guidelines. It is intended to promote the empowerment and active participation of stakeholders at all levels in fisheries governance. Implementation

is done through the step by step BMU formation procedure. Monitoring and enforcement is done by the BMU officials, central and county governments. Sanctioning and arbitration is done under the Fisheries Act CAP 378 and the Kenya Criminal Procedures Code CAP 75 of the laws of Kenya. Failure to adhere to the Fisheries Act provisions and BMU Guidelines by any fisher is considered an offence and attracts penalties and fines or jail terms depending on the nature of offence. Fishers on their own are less likely to engage in institutional change or device arrangements to directly resolve appropriation externality, resulting from the nature of their stocks. In addition, technological externalities are more easily solved by fishers because the type of behaviour in which rules focus, the design of rules used and ability of fishers to monitor and enforce, affects the costliness of monitoring as a by-product of harvesting fish. Assignment problems are easier to solve and less costly to monitor and enforce because areas and spots remain relatively stable over time.

The main players in the process of development and implementation of governance structures in the fishery are the fishers, Department of Fisheries and BMU officials. Fishers appreciate the input and effort of the department and BMU official in this regard but many expressed their perceptions and discontentment in various areas which include the length of time it takes local administrative authorities to apprehend and penalize rule defaulters; bureaucracy in the department in installing, maintaining and repairing of socio-economic infrastructure in the beaches/landing sites such as cooling plants; fear that the BMU officials are often compromised and therefore fail to articulate their (fishers) interests to the department and other stakeholders; that the arbitration and sanctioning of rule defaulters is punitive and discriminative that is, fishers of a higher economic and social status are favoured and can afford to pay the penalties. BMU officials are concerned on the high expectations of fishers and the department in carrying out their (BMU officials) duties, yet they do not receive any form of payment for their services. They cover long distances to attend meetings, oversee

activities in the beaches and organize recreational and welfare events. In other instances, they have little power to prosecute rule defaulters and this does not auger well with rule following fishers.

Fisheries officials shared their sentiments regarding the department's interactions with fishers through BMU officials. That often BMU officials conspire with fishers not to report rule breaking incidences to administrative authorities. BMU officials themselves being fishers do not entirely embrace various directives from the department which they deem very restrictive and authoritarian. The department's mandate is curtailed in cases where they require local administrative support for example, regarding patrol guards while fishers are out in the lake and general security in the beaches/landing sites. Due to few fisheries officers in the county, they face various challenges in monitoring and enforcing governance rules in the vast lake. Because of these divergences in the role, interests and power the fishers, BMU officials and the department various conflicts, mistrust and discontentment often arise that make effective operation of governance structures difficult to achieve. The power struggles compound the matter in the sense that the department as a government agency is perceived to be the 'iron hard' in the fishery governance by BMU officials and fishers.

Challenges Fishers, BMU Officials and Other Stakeholders Face in Lake Victoria Fishery

Fishers use rules to order their relationships regarding attributes of a bio-physical and material world and the nature of the community within which they are operating. However, some of these rules affect actions taken and outcomes obtained, consequently, giving rise to various challenges for the resource users. Fishers, BMU officials and other stakeholders face various challenges in their daily operations in the Lake Victoria fishery some relate to application of governance rules, management model applied and others to prevailing socio-

cultural, economic and environmental factors. These are shown in Table 4.5 below in order of importance and priority of respondents.

Table 4.5: Challenges

Fishers	Fishers	Fishers%
Low fish returns during the low fish catch seasons	7	35
Lack of proper cold storage facilities at the beaches	20	100
Poor road network to transport fish to markets	20	100
Fish price fluctuations and presence of many middle men/brokers/agents	20	100
Breakdown of family structures/cultural values because of infiltration of foreigners into the beaches	12	60
Lack of clean water and poor sanitation services	12	60
Rising competition and conflicts among fishers for fish stocks	20	100
Fish processing factories are located far away from the beaches (Homa Bay, Kisumu and Nairobi)	14	70
Poor electricity connectivity and lighting at the beaches	20	100
High incidences of insecurity (stealing of fishing gear or fish catch)	20	100
Lack of proper Personal Protective Gear for fishers	16	80
BMU Officials		
Unclear lake boundaries	BMU	BMU%
Inter-state conflicts with neighbouring countries	39	100
Laxity by authorized government administration officers in monitoring and enforcement	22	56
BMU officials are volunteers and not paid for the administrative their services	39	100
Administrative tasks for BMU officials are complex due to large numbers of fishers	39	100
Department of Fisheries		
Difficulty in disseminating information in written form due to low literacy levels of fishers	DoF	DoF%
High water and land pollution (both organic and inorganic)	1	100
Overfishing due to increase in the number of fishers	1	100

From Table 4.5 above, fishers indicated the highest number of challenges with 20/20 or 100% of the fishers having consensus on most of them. The main reason being that they are the ones involved directly in the actual harvesting, processing and sale of the fish stocks activities in the fishery. However, due to the type of fish species (Tilapia, Nile Perch or

Omena) that fishers harvest and the physical distance from the beach to the fishing grounds or spots in the lake, less than 20 fishers indicated lack of Personal Protective Gear (16/20 or 80%), fish processing factories located far away from beaches or landing sites (14/20 or 70%), lack of clean water and sanitation services (12/20 or 60%), break down of family structure and cultural values (12/20 or 60%) and low fish returns during low fish catch seasons (7/20 or 35%). This is followed by the BMU officials, themselves are fishers and work very closely with the fishers. All 39 BMU officials agreed on most challenges but less than 39 indicated unclear lake boundaries (30/39 or 77%) and laxities by authorized government administration officers in monitoring and enforcement of governance rules (22/39 or 56%). This also is due to the type of fish species (Tilapia, Nile Perch or Omena) that fishers harvest and the physical distance from the beach to the fishing grounds or spots in the lake. The Department of Fisheries gave the least challenges given that their degree of participation in the fishery activities is limited to administration as a state agency and having to work with BMU officials and not individual fishers.

Evolution of Management dynamics in Lake Victoria Fishery

The management style used in Lake Victoria fishery has evolved over time. Traditional systems of management and other community-based organizations have always existed at the fish landing beaches. Since the colonial days until early 1990s, fisheries resource management in Kenya had been based on the top-down centralized approach also known as command and control method. Stakeholders had never been consulted concerning management decisions, and biological recommendations were major inputs and informed the basis for policy formulation, legislation and resource management guidelines. Considering alternative systems of resource management, such as inclusion of the fishing communities in regulating and monitoring the resource is beneficial. Some of the benefits are: implementation, monitoring and enforcement costs are internalized within the community;

and ensures effective monitoring due to the vested interests they have in the resource (Abila, Lwenya, Geheb and Crean, 2000).

The current management of fisheries in Lake Victoria is guided by the FMP, produced in 2001 by LVFO, which is periodically revised to cater for new development in the resource system (LVBC, 2014). The plan is based on fisheries co-management aimed at getting the fisheries communities involved in fisheries management through beach level institutions and working with local and central government. The focal point of the plan is to build an enabling policy and legal framework in the Partner States for fisheries co-management and capacity building at all levels. The plan not only addresses a range of threats and challenges, but also recognizes opportunities and aims to increase benefits from fisheries exploitation. The development objectives are: earn foreign exchange for the three governments and improve the standards of living in riparian communities, increase fish supply to the riparian communities through more effective use of available fisheries resources at regional and national levels, create employment opportunities, particularly for riparian communities and implement the plan in line with specific management actions through a series of strategic goals and recommended activities. The plan was designed to address six strategic areas: (1) Regulation of fishing pressure within the framework of an adaptive management approach - access rights, fishing capacity and environmental issues. (2) Harmonizing and strengthening of the institutional environment for the fisheries development, research and management - co-management of the Lake Victoria fisheries, resource and socio-economic monitoring, HIV/AIDs in fishing communities, women in fisheries, safety in the lake and aquaculture research and development. (3) Establish an institutional environment that can manage sustainably a modified property and access rights regime using local community structures - institutional development and compliance to regulations. (4) Adoption of the Food and Agricultural Organization (FAO) Code of Conduct for Responsible Fisheries (CCRF) policy

matrix and Integrated Development Models (IDM) in a Lake Basin Management Context to develop strategies - policy and legislation. (5) Develop proper handling, preservation, processing and storage for fish and fish products - landing site development, fish trade, fish handling and processing (LVFO, 2014).

The EAC designated Lake Victoria and its basin as “an area of common economic interest” and “a regional economic growth zone” to be developed jointly by Partner States (Kenya, Uganda, Tanzania, Rwanda and Burundi). In line with this, in 2001, EAC established the LVBC formerly known as Lake Victoria Development Programme (LVDP), as a joint mechanism for coordinating the various interventions on the lake and its basin. It was also to serve as a centre for promoting investment and information sharing among the various stakeholders. Its focus is harmonization of policies and laws on management of environment in the lake and its catchment area and continuation of the environmental management on the lake. This includes control and eradication of the Water Hyacinth weed, management and conservation of aquatic resources and fisheries. Economic activities in the development of fishing, industry, agriculture, tourism, infrastructure and revamping the transport system on and around the lake. LVBC Secretariat coordinates the Lake Victoria Environmental Management Project (LVEMP), an EAC regional initiative project, currently implemented by the five EAC Partner States. Project partners include the World Bank, Global Environmental Facility (GEF), Government of Sweden and EAC Partner State Communities. The project aims to address major environmental concerns in Lake Victoria Basin which have had adverse impacts on the lake basin ecosystem, the region’s economy and livelihoods. These include deteriorating water quality, increased sedimentation, increased pollution and eutrophication, declining lake water levels, over-exploitation of natural resources including fisheries, wetlands and forests, resurgence of Water Hyacinth and other invasive weeds and adverse effects of Climate Change.

Management Model Applied in Lake Victoria Fishery

According to the LVFO, an effective co-management arrangement - which is a hybrid regime that combines centralized and decentralized state and community institutions - is widely seen as being the best option for sustainable management of fisheries on Lake Victoria - hence, the first step was to establish a network of BMUs around the lake. Early 1990s, a combination of high catch rates from the expanded Nile Perch stocks and high prices from international markets attracted levels of effort or fish harvesting rates (legal and illegal) that were non-sustainable and uncontrollable using existing management approaches. Thus, Lake Victoria being a shared resource, LVFO appealed to the then three Partner States (Kenya, Uganda and Tanzania) to adopt the BMUs as the common foundation for co-management of Lake Victoria fisheries. Benefits of BMUs in fisheries co-management include: (1) Allows the knowledge and understanding of all stakeholders to be reflected in the decision-making process and their diverse capabilities to be enhanced in implementation. (2) Potential to improve the sustainability of fisheries resource exploitation, increase efficiency in management and improve equity outcomes. (3) Resource users have the advantage of greater indigenous knowledge on the fishery than distant administrators of a top-down system. (4) Resource users get empowered, organized, motivated and gain a sense of ownership and control of the fishery. (5) Resource users can respond to signs of local overexploitation or damaging fishing activities, and nationally to lobby for appropriate changes in policy. (6) Seeking and incorporating the views of fishers in designing, developing and implementing management interventions boosts the legitimacy of the agreed regulations; consequently, easing monitoring, control and enforcement. (7) Local data collection and information exchange between resource users and government agencies reduces administrative costs and improves management decision making. (8) Co-management arrangements can enhance the position of disadvantaged groups by giving them direct representation in decision making in

the fishery. (9) Because of empowering fisher communities and from benefits derived from collective action there is an increase in the security of fisher livelihoods (reduced thefts, piracy and inter-group conflict incidences), potential sustainability of fishing activities (and hence catches), improving value added (through better handling facilities) and better prices obtained (through collective bargaining with traders). (10) BMUs act as a focal point for service providers to build awareness and capacity across a wide variety of issues, such as HIV/AIDS, alternative income generating activities and resource and savings mobilization.

The Partnership Fisheries Management model, which is a hybrid combination of centralized and decentralized of state and community, is used in Lake Victoria fishery. The main central state institutions involved in the management are the East African Community's Lake Victoria Fisheries Organization and Department of fisheries under the Ministry of Agriculture, Livestock and Fisheries. They provide administrative, scientific, governance, training and financial support. The BMUs are the community institutions. They provide diverse capabilities, indigenous knowledge, ease monitoring, control and enforcement, local data and information and build awareness and capacity on various issues affecting the fishing community. Thus, by utilizing the co-management model there are advantages for both state and local managers in that, there is great success in the fishery management with the basic rationale of both efficiency (higher quality and less costly information) and legitimacy (accountability in monitoring and enforcement). However, some of the limitations in the use of the co-management model include: the state agency that is, the Department of Fisheries may fail to adequately gather and analyse information about the status of the resource system. All parties may not amicably negotiate and agree on general parameters of regulatory measures aimed at reaching harvest targets or investment schedules to enhance and maintain the productivity of the system. All parties may not always develop specific regulations to

govern the harvest of fish stocks. The fishing community sometimes are not willing to bear the primary responsibility for implementation and enforcement of governance rules.

Factors Affecting the Management and Governance of Lake Victoria Fishery

Other than the management and governance structures applied in the Lake Victoria fishery, there are other internal and external factors that influence its management and governance. These are other internal and external factors that play a role in the efficient use, management, governance and sustainability of the Lake Victoria fishery. These are included in Table 4.6 below ranked based on numbers in each category.

Table 4.6: Internal and external factors affecting management and governance of Lake Victoria fishery

Environmental
Deteriorating lake water quality
Increased sedimentation
Increased pollution and eutrophication
Declining lake water levels
Over-exploitation of natural resources - fisheries, forests and wetlands
Resurgence of the Water Hyacinth and other invasive weeds
Climate Change effects
Deteriorating fish quality and size
Economic
Low fish trade at international, local and regional level reducing fishers returns/incomes
Poor socio-economic infrastructure around the lake
Inadequate resources and facilities which affects fisheries management, fish quality and handling
Insufficient financing for Lake Victoria fisheries management programs
Inadequate resource and socio-economic monitoring on the lake fish catches, stock levels and management
Increased incidences of child-labor and poor working conditions for fishers
Social
Poor general fishers' safety on the lake due to lack of proper Personal Protective Clothing
Low empowerment of women in the fishery and incidences of 'sex for fish' trade
Threat of HIV/AIDS among the fishing community
Inadequate skills and capacity building for fisheries management and research
Cultural
Cultural barring of women from participating in fishing activities
Sexual exploitation of women by men for favors in form of fish catch
Traditional myths and beliefs that discourage the use of modern fishing gear/equipment
Political
High incidences of inter/trans-boundary conflict over fishing grounds
Poor implementation of law enforcement and compliance mechanisms
Inadequate government support and effort for effective and sustainable fisheries management and development

In Table 4.6 above, environmental factors are ranked the highest as indicted by respondents. The reason for this being that given the nature of a fishery system, the bio-physical attributes play an important role in the growth and development of the fish stocks and therefore any negative changes any of them have detrimental consequences on the sustainability of the resource system.

A study titled, '*Ecological and Socio-economic Impacts of Invasive Water Hyacinth*' by Villamagna and Murphy (2009), gives the following findings: Water Hyacinth is one of the world's most invasive aquatic plants and is known to cause significant ecological and socio-economic effects. That the socio-economic effects are dependent on the extent of invasion, uses of impacted water body, control methods and response to control effects. Direct impacts include boating access, navigability and recreation; pipe systems for agriculture, industry and municipal water supply; and access to fishing grounds and fish catchability.

Table 4.7: Measures suggested to improve the management and governance of the fishery

Administrative
BMU officials and Department of Fisheries to make use of BMU fora to disseminate information such as, Annual General Meeting, open air meetings or ‘barazas’ and pictorial posters to for semi-literate members to understand.
BMU officials to do thorough vetting of members of BMUs through laid down guidelines and by-laws to be licensed to fish to avoid illegal fishing.
BMUs and Department of Fisheries to negotiate with the Government of Kenya and sponsors to replace and repair the cooling plants to reduce losses from spoilt fish catch.
Enforce punitive measures on fishers who fail to follow BMU guidelines and by-laws to deter non-compliance.
Fisheries Department to advocate for legislation on the fishing industry to regulate fish prices and avoid seasonal price fluctuations.
BMU officials to ensure landing of fishers is restricted to the specific beach for accountability and compliance to BMU guidelines and by-laws.
State Support
Government of Kenya (GoK) to increase the number of Administration Police and BMU patrol guards to beef up security and deal with emergencies at night when fishers are out in the lake.
GoK to provide additional economic infrastructure and social services and amenities among the fishing community such as, tarmac roads health clinics, schools, safe clean water, sanitation facilities and electricity.
GoK through the Department of Fisheries to have the BMU officials paid a salary to motivate them as they perform their duties.
GoK officials and BMU Chairpersons to arbitrate on behalf of fishers with authorities from other Partner States to resolve trans-bounder conflicts.
GoK to deploy additional security and patrol personnel along the beaches and in the lake at night while the fishers are out there fishing.
Environmental/Health/ Safety
National Environmental Management Authority (NEMA) to sensitize and assist the fishing community in addressing environmental issues especially at the beaches or landing sites.
Ministry of Health through Public Health Officers to mobilize beach clean ups and provide clean and safe drinking water points and regularly inspect the sanitary standards of fish handlers in the landing sites.
Ministry of Health to ensure fishers are supplied with basic Personal Protective Gear or sell to them at a subsidized price.

Table 4.7 above shows the suggestions made by the fishers, BMU officials, Department of Fisheries and other stakeholders on how to improve the fishery. As indicated, most of the measures suggested by respondents fall under the administrative category specifically, on the

BMUs and Department of Fisheries. State support category follow in areas of socio-economic infrastructure, patrol guards, financial motivation of BMU officials, security and trans-boundary conflict resolution. The least is the environment/health/ safety category which emphasises on the need for lead state agencies and ministries support and participation.

4.7 Conclusion

The evolution of the management model over time has ensured improvement and efficiency in the use of the fishery resources and enabled fishers to overcome governance challenges by incorporating the expertise of other stakeholders. Application of co-management model in Lake Victoria fishery has yielded various benefits to the fisher community specifically, the Kenyan economy and East African region in general, regarding meeting sustainable development objectives. Stakeholders in the fishery play a major role in ensuring the efficient use and management of the fishery. The governance structures applied have enabled the fishers to coordinate their use of fishing grounds and consequently overcome appropriation, technological and assignment externalities or problems. Involvement and participation of various stakeholders in developing, designing, implementing, monitoring, enforcing, sanctioning and arbitration of the governance rules; each bringing in their expertise ensures efficient use, management and sustainability of the fishery. Challenges that fishers face are not only limited to complexities of human behaviour in the use of shared natural resources but are further compounded by the characteristics of the resource and socio-cultural factors of the community. In addressing these challenges, fishers collaborate with other stakeholders through the application of the co-management model to find lasting and sustainable solutions. Various internal and external factors affect the management and sustainability of the fishery, ranging from economic (financial and marketing), socio-cultural (community attributes), political (administration and governance) and environmental (size and quality of resource).

The efficacy of community-level fishery co-management of BMUs lies in their mandate to enhance sustainable Lake Victoria fishery management. This is done through increased level of community participation to assist in the administration of fisheries rules and regulations by, and for, the fishers. Inefficiencies have emerged which inhibit the effective execution of sustainable fisheries management by the BMUs. Lack of compliance may be due to lack of adequate financial and equipment resources for monitoring, control and surveillance (MCS) operations hence, not being able to control illegal fishing in their area of jurisdiction. Further, financial mechanisms, which would allow BMUs to sustainably fund their administrative and MCS operations, are weak consequently, reducing their ability to effectively function. However, they highlight two activities illustrating significant indices of good performance (success of a CPR); namely, resolving disputes and receiving visitors (non-group members). The creation of BMUs therefore, may not have ensured successful implementation of co-management of Lake Victoria fishery. This is mainly because BMUs are successful at activities of a social nature, but have poorly undertaken their core functions related to enforcement and compliance with fishing rules.

However, fishers, BMU officials, Department of Fisheries and other stakeholders in Lake Victoria fishery suggested measures in which the co-management model and governance structures can be strengthened. By improving on the administration activities that empower the BMUs to ensure efficient implementation of rules and participation and capacity building of fishers in sustainable management of the fishery. Environmental, health and safety for holistic growth and development of the fishing community. Government involvement and support in terms of financial, infrastructure and legal framework to make enforcement effective.

CHAPTER FIVE

THE CASE OF MWEA RICE IRRIGATION SCHEME

5.1 Introduction

This chapter outlines the case of Mwea Rice Irrigation Scheme (MRIS) based on the study's general objective which is to understand the evolution in management dynamics and operation of governance structures in the Common Property Resources (CPRs). The specific objectives are to: (1) Examine the evolution of management dynamics in the scheme over time. (2) Examine the management model used in the scheme and its functioning. (3) Explore the governance structures and challenges of implementing them in the scheme. (4) Explore critical variables related to user groups, institutional arrangement and external environment in the scheme. (5) Suggest measures to improve the management and governance of the scheme.

The study area is the MRIS also known as Mwea-Tebere Irrigation Scheme, located in Kirinyaga South District of Kirinyaga County in Central Province with a gazetted land area of 30,350 acres. It is the largest rice irrigation system in Kenya, generating more than 80 per cent of all rice produced in the country. It was established in 1955 as part of the government policy on food-sufficiency as well as to provide rural populations with economically viable livelihoods (Kenya Open Data, 2014). The outline of the chapter entails general descriptions of management and governance issues in an irrigation system as a CPR, background of the Mwea Rice Irrigation Scheme, data presentation, analysis and discussion, conclusion, and recommendations.

5.2 Literature Review

Management in Irrigation Systems

According to Ostrom and others (1994), operating irrigation systems is more than a technical issue. This is evident from the failure to meet operational targets or rapid deterioration of

many technologically sophisticated large-scale irrigation projects. The main reason for these failures is a lack of institutional arrangements that can effectively resolve CPR problems faced by irrigators. Management issues in irrigation systems stem from two features of CPRs. First, exclusion is nontrivial given that the high cost of exclusion is due to the size of water delivery facilities, the flow nature of water and legal doctrines or government policies which mandate that whoever cultivates land within certain areas is entitled to water. Second, water is subtractable and the flow of water available at one time in an irrigated system is scarce in an economic sense. Thus, irrigators face appropriation externalities, when the amount of water is insufficient to satisfy everyone's cultivation needs, that is, water needs to be allocated in a way that ensures efficient use. To deter the temptation by irrigators to break the rules that limit water allocations, the allocation of water is based on the number of shares held or amount of land cultivated. Provision problems arise when substantial resources are needed to construct and maintain water retention and diversion facilities such as dams, canals and pumps (Ostrom et al, 1994). In the case of MRIS, due to its large scale, there are high costs of exclusion as water flows from the primary system (intake and main canals), to secondary system (branch canals) and then to tertiary system (main and sub-feeders). Thus, rice farmers face various appropriation and provision problems in the process of regulating water flow and its distribution among members of the scheme. Rice farmers are thus able to solve management problems arising from appropriation and provision externalities by applying the Participatory Irrigation Management (PIM) model. The water delivery system and investments are undertaken by the Mwea National Irrigation Board and is only availed to the rice farmers based on scope rules of fixed-percentage of water, fixed-time slots to withdraw water, fixed orders to take turns in receiving water and the set minimum water required and maintained in the system.

Governance in Irrigation Systems

Ostrom and others (1994) argue that irrigators develop and design governance structures to specify the amount of contributions (labour or money) required of each irrigator for constructing and maintaining physical facilities and water allocation activities. Operational rules such as, boundary, choice or authority rules specify what is allowed, required and forbidden in making day-to-day operational decisions while collective-choice rules specify the terms and conditions for interpreting, enforcing, and altering operational rules in the system. These governance structures include: (1) Position rules which specify the set of positions: appropriator - a farmer and member of farmers' association, provider of infrastructural investment, member of a tribunal (to advocate disputes over appropriation and provision), officials of the association, maintenance of system, water distributor and guard. (2) Boundary rules which define how participants enter or leave these positions: land - farm within a specified physical distance, ownership or leasing of land in the area, shares - ownership or leasing of shares, transferable independently of land, to ascertain portion of water flow or water delivery facilities, membership in an association, fee-payment of certain entry fees each time before appropriation of water, an irrigation association rules that specify how a farmer becomes a member and the qualifications that individuals must have to be eligible for office positions in the association. (3) Choice or authority rules which specify the set of actions: lease of rights - to or from holder of usage rights, lease of land in the area, pay fine instead of providing maintenance services, delegation of provision to third party and rules of the association, specific next actions to be taken by a water distributor or guard in case a farmer challenges their initial actions. (4) Information rules which specify information available: standardized measurement of appropriations, reporting of illegal appropriation to higher authority, reporting of provision levels and rules that specify how information is disseminated for example, that the financial records of a farmers' association must be

available to members at the time of the annual meeting. (5) Aggregation rules which specify the transformation function: collective-action rules proportional to shares, defining levels of provision required, reimbursement of additional contribution (fees) and determine the procedure of changing association rules. (6) Payoff rules which specify how benefits and costs are required, permitted or forbidden: setting the rate of interest for lease of share, reimbursement for unused shares, fixed penalty for unreported appropriation, price for appropriating a unit volume of water, fees for under or over provision of maintenance work what crops may be grown, whether a farmer may sell any water received from the system, how guards are paid and what labour obligations may be involved to keep the system maintained. (7) Scope rules which specify the set of outcomes: fixed-percentage (flow of water is divided into fixed proportions by some physical device), fixed-time slots (each farmer is assigned fixed-time slots during which he/she may withdraw water), fixed-orders (farmers take turns to receive water) and minimum water levels required for navigation or for generation of power (Ostrom et al, 1994).

Further, Ostrom and others (1994) argue that the performance or extent to which appropriation and provision problems are solved for an irrigation system can be measured by three outcomes: (1) a system is well maintained, which depends on coordinated inputs from irrigators. Since its initial construction and physical environments are given, this outcome reflects the extent to which the farmers succeed in coordinating their provision activities. (2) Most irrigators follow operational rules that reflect coordination of various maintenance and water allocation activities, which in turn determines the viability of rules coordinating devices. (3) Water supply is adequate for all irrigators, which depends partly on whether the water retention and transportation structures are properly maintained and whether the existing water flow is efficiently allocated. In some cases, even if appropriators cooperate in rule enforcement and maintenance, an appropriation resource may still have inadequate supply of

water. This is due to constraining factors beyond the appropriators control such as, few rivers which is an environmental constraint, or location of the area within the larger system, or decisions taken by water officials (Ostrom, et al, 1994).

In MRIS, rice farmers and other stakeholders solve appropriation and provision problems by devising governance structures which ensure that the system is well maintained, there is coordination of maintenance and water allocation activities and water supply is adequate for all rice farmers in the scheme. Since the rice farmers have an incentive to refrain from investing in construction and maintenance of irrigation facilities, the inclusion of other stakeholders, specifically the NIB, help them in solving provision problems. In addition, external factors work in favour of the rice farmers in that the rivers supply adequate water, the location is on a low land terrain which makes water flow evenly through the system cycles and decisions taken by the water officials are in tandem with the Mwea Irrigation Water Users Association's (IWUA) Constitution provisions.

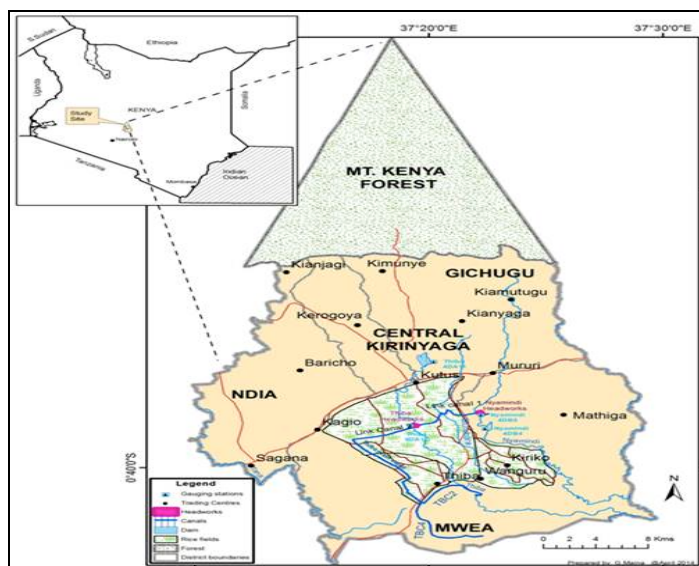
5.3 Biophysical and Community Attributes of Mwea Rice Irrigation Scheme

Kenya has had a successful agricultural sector since the early 1950s. From the 1960s, various policy interventions in the sector including marketing, research, credit extension and price controls have been implemented. The aim being to promote cooperatives, farmer based companies, and agro-based industries for processing agricultural products. In Kenya, rice is the second major cereal after maize, and has largely developed as an irrigation crop, although small amounts are produced under rain-fed conditions. To promote rice growing under irrigation, a National Irrigation Board (NIB) was established as a parastatal, in 1966 through an Act of Parliament, Chapter 347 of Laws of Kenya to develop irrigation schemes; process paddy into rice and market the rice on behalf of farmers (GoK, 2014).

MRIS is in the eastern slopes of Mount Kenya, about 100 kilometres from Nairobi city. It was started in 1956 by the British colonial government with rice as the predominant crop grown and its first tenant farmers were political detainees from the 1953 Mau Mau rebellion (Elkins, 2005). The climate is semi-arid with an average annual precipitation of 950 millimetres, with long rains between March and April and short rains between October and December. It is bounded by latitudes 37°13'E and 37°56'E, longitudes 0°10'S and 0°54'S and an altitude of 1,100-1200 metres above sea level. Kirinyaga County transverses three agro-climate zones, with maximum moisture availability ratios ranging from 0.65 in the highland slopes, to 0.50 for the vast low areas and 0.40 for the semi-arid zone. This is based on the ratio of measured average rainfall for calculated average annual evaporation. The area is generally hot, with average temperatures ranging between 23°C and 25°C with about 10°C difference between the minimum temperatures in June to July and maximum temperatures in October to March. The predominant soils are vertosols, which are characterised by imperfectly drained clays, very deep, dark grey, very firm and prone to cracking. The most appropriate season for rice cultivation (monocropping) is from August to December, when temperatures are opportune for grain filling and with less risk of disease incidence. However, this period is also when the rivers flows are at their lowest, coinciding with the dry season, further putting a strain on water availability for irrigation. Environmental factors suitable for rice growing include climate (humidity and temperature), soil (texture, Ph and drainage) and topography (slope) (Kihoro et al, 2013). It is one of the seven schemes under the management of the NIB. The large scale of MRSI is manifested in terms of: The geographical size as indicated earlier, it is the largest rice irrigation system in Kenya with five main geographical sections that is, Mwea, Thiba, Karaba, Tebere and Wamumu and two out-growers, Ndekia and Curukia. Of the gazetted area of 30,350 acres 16,000 acres has been developed for paddy production and an additional 4,000 acres of out-grower and 'jua kali'

(informal) areas under paddy production. The rest of the scheme is used for settlements, public utilities, subsistence and horticultural crops farming. The scheme system has three divisions that is, the primary (intake and main), secondary (branch canals) and tertiary (main and sub-feeders) which are served by water extracted from River Nyamindi, River Thimba and River Curukia via gravity fed intake weirs located in Kirinyaga South District of Kirinyaga County. (2) The number of users (rice farmers), the total population of Kirinyaga County is 528,054 persons of which 190,512 reside in Kirinyaga South District. MRIS supports a population of over 50,000 persons, organized in approximately 3,242 farm families living in 36 villages (Kenya Open Data, 2014).

Figure 5.1: Kirinyaga County



Source: Google Maps

5.4 Methodology

The study adopts a Qualitative Research (QR) methodology and was conducted using a survey research design at a group level in this case, the rice farmers, who are members of the MRIS located in Kirinyaga County. They who co-own the scheme with the government, enjoy all property rights in the irrigation system and own land on which they grow rice using water and other facilities such as, roads, granaries, grinders, threshers provided by the system. The target population comprise (1) officials of Mwea Irrigation Water Users Association in

Mwea Rice Irrigation Scheme. (2) Representatives of Community Based Organizations (CBOs), government organizations, ministries and agencies, educational and research institutions, environmental conservation organizations, financial institutions, media and telecommunication organizations, religious organizations, Non-Governmental Organizations (NGOs) and United Nations agencies in Kirinyaga County working with the rice farmers in the scheme. The sampling process involved identifying the rice farmers' association (Mwea Irrigation Water Users Association) and specific organizations working in MRIS. Primary data was collected using structured interview guides addressed to the target population, informal face-to-face discussions between the target population and the researcher and general observation of community behaviour by the researcher. Secondary data was sourced from Government of Kenya electronic data base - Kenya Open Data, Government of Kenya relevant documents that is, the Constitution, National Land Policy, and the Environmental Management and Coordination Act (EMCA), 1999. The researcher also sourced additional information from various publications by the above organizations, their data bases and other literature on the economic, socio-cultural, political and environmental issues in CPR management.

5.5 Data Presentation, Analysis and Discussion

Total Sample

The total sample selected for interview comprised of 2 executive officials, 5 branch canal representatives, 5 Unit leaders, 10 Line leaders of Mwea Irrigation Water Users Association (IWUA), 20 farmers, the Manager of the Mwea National Irrigation Board and 1 representative of: Mwea Irrigation Agriculture Development Centre (MIAD), Mwea Rice Millers Limited (MRM), Mwea Rice Growers Multipurpose Co-operative Society (MRGM) and Kenya Agricultural and Livestock Research Organization (KALRO). This is shown in Table 5.1 below.

Table 5.1: Total sample

Respondents	Number
Mwea IWUA Executive	2
Mwea IWUA Branch Canal Representatives	5
Mwea IWUA Unit leaders	5
Mwea IWUA Line leaders	10
MRIS Farmers	20
Manager Mwea NIB	1
MIAD	1
MRM	1
MRGM	1
KALRO	1

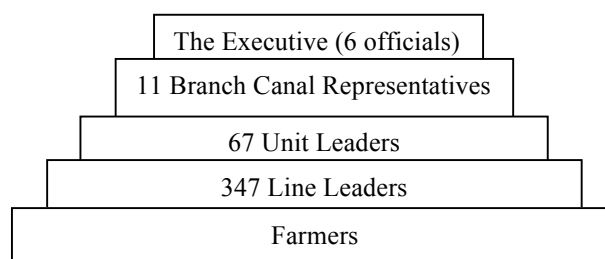
Sections, Out Growers and System Divisions

The scheme system has five main geographical sections that is, Mwea, Thiba, Karaba, Tebere and Wamumu; two out-growers, Ndekia and Curukia; and three divisions that is, the primary (intake and main), secondary (branch canals) and tertiary (main and sub-feeders) which are served. by River Nyamindi, River Thimba and River Curukia as shown in Table 5.2 below.

Table 5.2: Sections, out growers and system divisions

Main Section	Out Growers	System Division
Mwea	Ndekia	Primary (intake and main canals)
Thiba	Curukia	Secondary (branch canals)
Karaba		Tertiary (main and sub-feeders)
Tebere		
Wamumu		

Structure of Mwea Irrigation Water Users Association

Figure 5.2: Hierarchal Structure of Mwea IWUA

Source: Mwea IWUA, 2014

As shown in figure 5.2, the Mwea IWUA is made up of: (1) Management Committee comprising of the executive and branch canal representatives, whose mandate is to set the

policy framework for Mwea IWUA and make rules of business for the executive committee. Regulate, control, plan and administer the management of irrigation water allocated by the government agency. Consider, approve or reject application for membership and prepare a program of establishment or operation of water supply. Convene meetings for members, call for annual general meetings and prepare annual financial budgets. Supervise the maintenance of members' register and impose fines and penalties in accordance with association rules and by-laws, float and award contracts. Inspect irrigation and drainage systems and distribution of water to ensure no wastage, misuse or unauthorized use. Arbitrate and deal with conflicts on water distribution and correspond with government agencies on irrigation matters and maintain good working relations with them. Ensure the best use of water, train and educate rice farmers on cropping, water management, optimal and efficient use of water and soil maintenance. Ensure that the Mwea IWUA Cash Book is updated promptly and signed by the treasurer and organize for the auditing of Mwea IWUA's books of account. Designate, employ on remuneration and dismiss personnel. Scrutinize books of account and take steps for recovery of all sums of money owed to Mwea IWUA. Source funds for Mwea IWUA and take any action to ensure and help meet the objectives of IWUA. (2) Executive Committee comprising of a Chairperson, Secretary, Treasurer, Vice Chairperson and Vice Secretary which carries out daily activities of Mwea IWUA and submits reports to Management Committee. Implements strategic plans and decisions of the Management Committee. Represents Mwea IWUA in stakeholders' meetings and fora and ensures effective participation of Mwea IWUA and service providers in management of the irrigation scheme. (3) Sub-Committee appointed by executive committee with approval of management which submits various reports to the Executive Committee.

Requirements for Membership in the Mwea Irrigation Water Users Association

To qualify as a member of the Mwea Irrigation Water Users Association (IWUA), rice farmers are required to perform certain duties and observe certain responsibilities after which they gain user rights in scheme. Duty to pay membership fee, pay annual subscription fee, O&M fee as required, use irrigation water efficiently. Enforce O&M fee payments by arresting defaulters using law enforcement agencies and penalizing them upon arrest, attend communal works of irrigation and drainage system as required. Maintain all the irrigation structure within the area of command, follow the cropping program, protect and maintain good environment for sustainable agriculture and attend meetings. Rights such as, being involved in making of maintenance program, being involved in cropping program arrangement, follow up maintenance and cropping programs, vote for their leaders and stand for election at the Branch Level. Mwea IWUA gets its funding from various members' registration fee, annual subscription fees, O&M fee, donations and grants, fines and penalties, financial institutions and payments made for the use of Mwea IWUA property or equipment.

Role of Mwea IWUA in the Mwea Rice Irrigation Scheme

The Mwea IWUA has the mandate to ensure proper cropping program and that work plans are in place and unite all registered Mwea IWUA members. Carry out effective O&M of irrigation and drainage facilities and related activities and ensure maximum conditions for crop cultivation by irrigation for the benefit of members and sustainable agriculture. Implement association's cropping program and minimize production costs by engaging in rotation activities. Engage in harvesting activities and supervise all tractors rotavating activities. Penalize tractor owners who do not use ladders while rotavating in the scheme and enforce law and order and conditions or rules set for crop cultivation. Offer capacity building services to members, adopt new modern water use and management technologies and distribute irrigation water equitably at the tertiary system level (main and sub-feeders).

Other Stakeholders and their Role and Interest in the Mwea Rice Irrigation Scheme

The rice farmers and the Mwea IWUA officials consults and cooperates with local (now county) government, relevant agencies of central government and lead agencies and other stakeholders in their daily operations in MIRS. These include:

National Irrigation Board (NIB)

Offers capacity building and training services to rice farmers and Mwea IWUA officials. Maintains the primary (intake and main canals) and secondary (branch canals) system divisions. Offers land administration services to rice farmers and undertakes expansion and rehabilitation activities within the irrigation scheme. Coordinates and plans settlements in the irrigation scheme. Provides either by itself or by agreement with other persons for processing of rice, promote its marketing and liaise with organizations responsible for its marketing. Conducts Research and Development (R&D) through the Mwea Irrigation Agriculture Development Centre (MIAD) and other national and international research institutes.

Mwea Irrigation Agricultural Development Centre (MIAD)

Undertakes research activities relating to agricultural/irrigation water management and bulking of paddy seed for sale to farmers. It is a Centre for irrigation technology development and transfer of on farm water management, wetland preparation, rice husbandry and multiple (double) cropping techniques. Specializes in rice germplasm maintenance, rice seed production, soil, water and plant tissue analysis and in-house trainings related to irrigation management. Collaborates with NIB and Mwea rice farmers to perform trials and conduct research on farming methods and inputs.

Mwea Rice Millers Limited (MRM)

This is the main producer and miller of the Kenyan Pishori Rice and ensures that the processing of rice is monitored from planting to harvesting and milling. Selects, analysis and

passes on to stores for a minimum period of three months the harvested paddy to allow for curing and aging process before milling. Ensures that rice is milled and packed in hygienic conditions while preserving its unique aroma.

Mwea Rice Growers Multipurpose Co-operative Society (MRGM)

Operates land tillage rotavating by use of rotavators in wet field and disc plough in dry land. Provides rice farmers with farm inputs such as, quality seeds, fertilizers, agro-chemicals and harvesting materials such as, sisal twines, sickles and gunny bags. Provides extension services by Agricultural Officers on crop husbandry. Provides transport services for delivery of produce from fields to stores and white rice and by-products to customers and other services. Provides packaging materials such as, gunny bags and packets and receives and weighs individual member's produce. Standardizes and stores rice at the recommended moisture content, removes husks from paddy rice, polishes (whitening) and packs it and produces rice by-products in form of fine bran, course bran and animal feeds.

Research Collaborators

These include: Jomo Kenyatta University of Agriculture and Technology in up scaling System of Rice Intensification (SRI); Syngenta, Dipchem and Farming Science to perform Fungicide, Pesticide and Herbicide trials; research and education institutions such as Kenya Agricultural and Livestock Research Organization (KALRO), University of Nairobi, International Institute of Rice Research (IRIRI), Technical University of Kenya, Kenya Plant Health Inspectorate Services (KEPHIS), National Commission for Science, Technology and Innovation (NACOSTI); and Japan International Cooperation Agency (JICA).

The other stakeholders are not directly involved in the management and governance of the resource system, rather, in providing inputs, crop husbandry, research and development (R&D), processing, marketing, financing and sale of the rice produce. They simply perform

specific roles in the scheme for example, MIAD which undertakes R&D in terms of irrigation agriculture water management, MRGM which operates the land tillage, MRM which produces and mills the rice, and others.

Governance Structures Used by rice Farmers in MRIS

Governance structures specify the amount of contributions (labour and money) required of each rice farmer for constructing and maintaining physical facilities and water allocation activities. Performance or the extent to which appropriation and provision problems are solved in irrigation systems depend on how well a system is maintained, coordination of various maintenance and water allocation activities and adequate water supply. Rice farmers in MRIS apply various governance rules in their day to day operations in the irrigation system in terms of appropriation and provision as shown in Table 5.3 below.

Table 5.3: Governance Structures

	MIW UA	MIWU A%	NI B
Position rules			
Appointment of guards among the rice farmers	22	100	1
Appointment of a tribunal to settle disputes among rice farmers	22	100	1
Boundary rules			
A rice farmer is required to farm within a specified physical distance	22	100	1
A rice farmer may own or lease land in the area	22	100	1
A rice farmer may own or lease shares in the rice irrigation scheme	0	0	0
A rice farmer to pay certain fees for water supply	10	45	1
Other (specify) -specify cropping programme to be used	22	100	1
Choice or authority rules			
Specifies who can lease land in the rice irrigation scheme	5	23	1
Aggregation rules			
A set procedure for changing rice farmers' association rules	5	23	1
A rice farmer to report any illegal water use observed to higher authority	22	100	1
A rice farmer to report maintenance services they perform in the rice irrigation scheme	5	23	1
Set procedures of passing all important information to rice farmers	22	100	1
Payoff rules			
Set interest rate for leasing of shares in the rice irrigation scheme	0	0	0
Fixed penalty fees for unreported farming in the rice irrigation scheme	5	23	1
Reimburse a rice farmer for unused shares in the rice irrigation scheme	0	0	0
Determine how the guards are paid	22	100	1
Fixed-percentage where water is divided into fixed amounts and distributed to rice farmers using a physical device to regulate it	22	100	1
Fixed-time slots where each rice farmer is assigned a period during which he/she may withdraw water from the scheme	22	100	1

Figure 5.3: Choice/authority rules

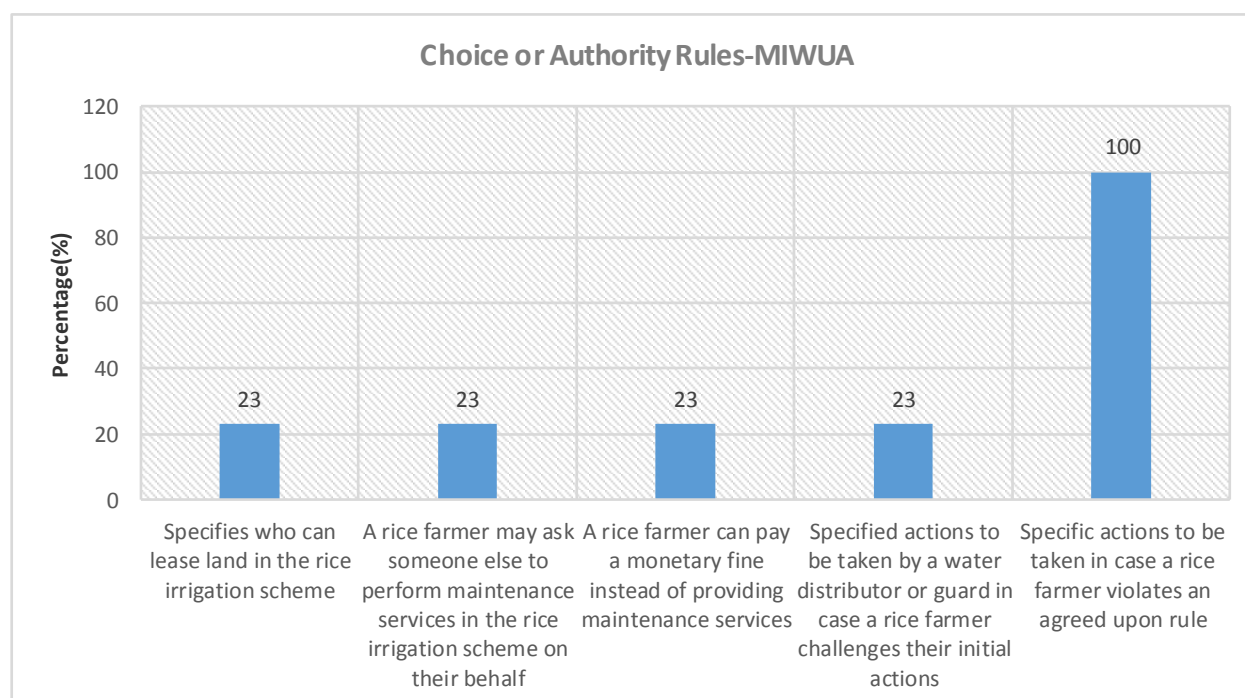


Figure 5.4: Aggregation rules

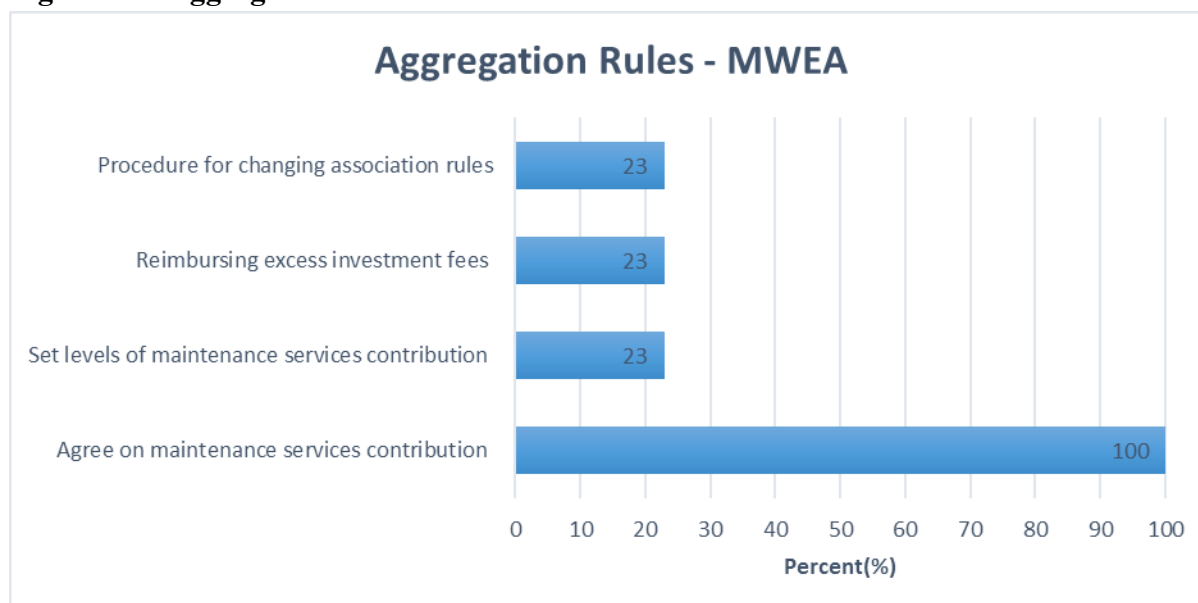
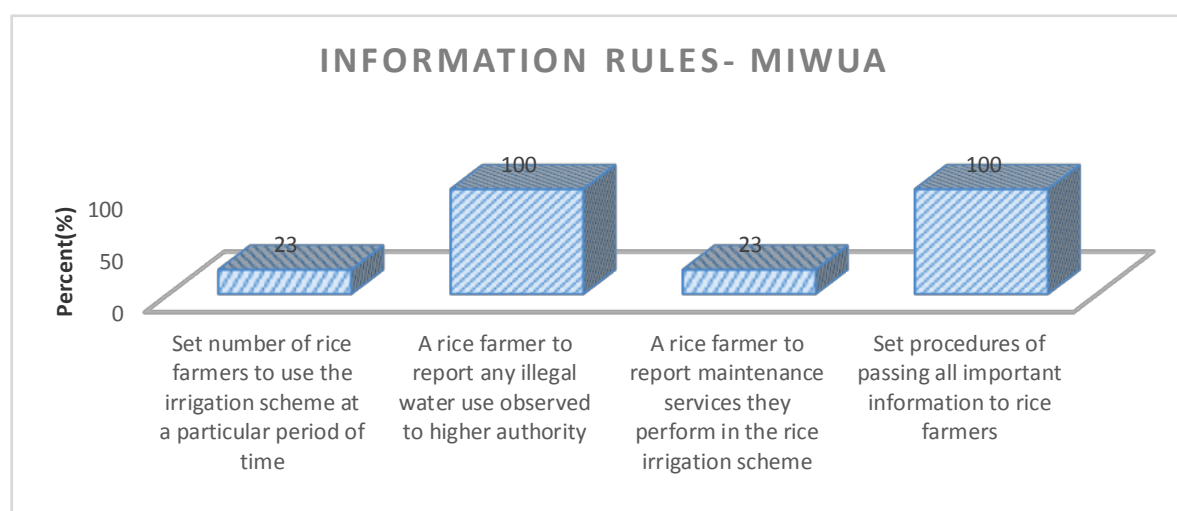


Figure 5.5: Information rules



According to Table 5.3 and Figures 5.3, 5.4 and 5.5 above, respondents indicated position, boundary and scope rules as the most used rules (22/22 or 100%) in MRIS. However, boundary rules that a rice farmer may own or lease shares in the scheme is not applied (0/22 or 0%) because this is prohibited in the Irrigation Act, CAP 347; and that a rice farmer may pay a certain fee for water supply (10/22 or 45%) is applicable in the out growers' section of the scheme. The reason is that these are rules contained in the Mwea IWUA's Constitution and therefore, are more familiar and applicable to rice farmers as members of the association. Scope rule to determine minimum water required and maintained for navigation or generation of power in the scheme only 5/22 or 23% indicated its application because this activity is regulated and enforced by NIB water engineers and most of the Mwea IWUA officials may not be aware of it. The choice, aggregation and pay-off rules which are formulated by NIB and others contained in the Irrigation Act, CAP 347 of Kenya Laws are indicated mainly by the 5 Mwea IWUA officials and the Mwea NIB Manager, who are more acquainted with them compared to the individual rice farmers. The other rules not applied are prohibited in the Irrigation Act, CAP 347.

The rice farmers and NIB are the main stakeholders in the irrigation scheme as far as governance of irrigation system is concerned. Rice farmers have for a long time wanted autonomy in the governance of the scheme but due to constant political incitements, their protests against NIB and Mwea IWUA formulating and implementing governance structures has not yielded much. The cost of investment and maintenance of the scheme's infrastructure being exorbitant, further compounds the matter. Rice farmers also feel the state social cohesion that existed among them has been eroded by an influx into the scheme by people from other areas who have bought or leased land from initial owners in the scheme. The Mwea IWUA officials expressed displeasure in the way water issues are addressed by NIB; that the O&M fees are too low to sustain the association's financial needs; that the political interference by local government in the governance of the scheme is further compounded by the rigid requirements by NIB to own or lease land in the scheme. The NIB manager and water engineers feel that it is not advisable to give total autonomy of the scheme to the farmers and Mwea IWUA due to the technical nature of the irrigation infrastructure that require huge financial investment and engineering expertise which they (rice farmers) do not have.

Phases in Governance Structures

In most irrigation systems, governance structures are created and enforced by irrigators themselves, farmers' associations and government agencies. In MRIS, this is done based on the Mwea IWUA Constitution and the Irrigation Act CAP 347 of Kenya Laws. They indicate the specific roles, duties and responsibilities of the Minister for Agriculture, Livestock and Fisheries, NIB; NIB Mwea Scheme Manager and licensed rice farmers (licensees) and spells out the offences of non-compliance and penalties applicable thereof. Efficient and effective operation and maintenance in the system has been realized because: (1) governance structures match different physical domains such as, soil types, topography, cropping patterns and

amount of water available. (2) At the water course level, knowledge about local conditions is utilized when designing, developing and enforcing rules and choices. (3) Rules are implemented after intensive trial and error by rice farmers who share a common understanding of the rules they have developed. (4) Rice farmers have lived together for a long time and have developed social networks and reciprocal relationships with one another, therefore, they are able to utilize this social capital to design, develop and enforce governance structures. (5) Governance and management of the irrigation system is undertaken by various stakeholders - rice farmers, Mwea rice farmers' association (IWUA) and government agency (NIB). (6) Rice farmers are involved in the designing, development and enforcement of governance structures, which facilitates their adaptation to the specific environments of different appropriation areas. (7) Involvement of rice farmers in designing, developing and enforcing of governance structures has made them effective in meeting local needs as characterized by the high degree of rule conformance and maintenance (GoK, 2014).

Challenges that Rice Farmers, IWUA Officials and Stakeholders Face in the MRIS

Rice farmers, IWUA officials and NIB personnel face various challenges in their daily operations in the MRIS as shown in Table 5.4 below. Some relate to application of governance structures and others to the prevailing economic, socio-cultural, political and environmental factors. Most of the challenges were given by the rice farmers and Mwea IWUA officials and focus mainly on the issue of water management in the scheme, processing and sale of the rice produce.

Table 5.4: Challenges

	IWU A	IWUA %	NI B
Water shortages	22	100	1
Poor state of infrastructure (canals, roads and water)	22	100	1
High incidences of pests and diseases	22	100	1
Lack of adequate control and regulation of planting materials	22	100	1
Inadequate agricultural extension support	22	100	1
Inadequate funds to carry out O&M services on the scheme infrastructure	22	100	1
Fluctuations in paddy prices	22	100	1
Incidences of traders using Mwea rice to blend lower quality imported rice suppressing its market prices	22	100	1
Aging and obsolete milling machines at the Mwea Rice Mills	22	100	1

Evolution in Management Dynamics in MRIS

The MRIS was started in 1946 by the British colonial government as a settlement scheme for residents of the now Kirinyaga South District in Kirinyaga County. All management operations were undertaken under the African Land Development Unit (ALDEV). After independence, the management of the scheme was handed over to the Ministry of Agriculture under which the NIB was established and incorporated in 1966 as a state corporation through the Irrigation Act of parliament, CAP 347 of the Laws of Kenya, to take over the management and running of the MRIS from ALDEV. The Act vested all powers on NIB and this caused great displeasure to the rice farmers, who felt they had no say in the management of the scheme. Consequently, farmers' associations emerged to represent their interests. However, due to lack of an enabling environment and internal management wrangles, they were unstable and ineffective for a long period of time and constantly underwent numerous transformations. The first association was the Mwea Irrigation License Tariff Cooperative Society which later changed the name to Mwea-Tebere Cooperative Savings and Credit Society Limited. In 1967, a sub-branch of this was formed under the name Mwea Farmers' Cooperative Society with the same membership and management. In 1983, the two societies incorporated a banking section and merged to form Mwea Amalgamation Rice Growers' Cooperative Society Limited. In 1993, this society split up again to form the Mwea Rice

Growers' Multipurpose Cooperative Society Limited and Mwea Rice Growers' SACCO Society Limited (Kabutha & Mutero, 2012). MRIS was established as part of the government policy on food-sufficiency, as well as to provide rural populations with economically viable livelihoods. Land tenure is on tenancy basis and the scheme is run by NIB and farmers' associations, mainly the Mwea Rice Growers Multi-Purpose Cooperative Society Limited (MRGM), and Mwea Irrigation Water Users Association (IWUA). MRGM manages the scheme with, and on behalf of, the farmers. The NIB is responsible for all the main infrastructure, water management in the main and secondary canals, making of cropping program and land administration in the scheme. Mwea IWUA is responsible for water management in the tertiary unit, facility maintenance in the tertiary units except roads, and farmers' payment of Operations and Maintenance (O&M) fees. The scheme is developed on a gazetted land and farmers were settled as tenants each with a holding of minimum 4 acres. However, due to increase in population, most of the holdings have been subdivided among family members or transferred to new farmers. Since its inception till 1998, the scheme was solely run by the NIB as mandated by Irrigation Act Cap 347. NIB is responsible for production activities which include land preparation, credit provision, crop husbandry services, harvesting and post-harvest services and marketing. This system collapsed during the 1998/99 crop when farmers revolted and refused to deliver their crop to NIB and instead demanded that they be allowed to market it themselves (GoK, 2014).

Because of this sudden change in the role of NIB in the scheme, the management was taken over by a Mwea Rice Farmers' Cooperative Society (MRGM). Due to lack of skilled personnel, finances and machinery for scheme maintenance among farmers, the infrastructure deteriorated and tail enders could not crop. In 2003, the farmers upon realizing that they cannot go it alone approached the government for assistance in the scheme management. NIB underwent a restructuring process to change the mode of service delivery to farmers and non-

core roles were devolved to the farmers and other stakeholders. The core mandate of NIB is water management, operation and maintenance of infrastructure in the scheme. It does this by facilitating the formation and strengthening of Mwea IWUA to involve farmers in the scheme management. In order to provide for this, some of the clauses in the Irrigation Act are no longer applicable. This has allowed farmers to play more roles in scheme for example, production and marketing of crops, farmers have permanent ownership of their farms, no restrictions on the activities they undertake in their farms or villages including the number of animals and children in their homes. The Constitution of Kenya (CoK), 2010 has also provided a new impetus for the implementation of the new draft Irrigation Bill which was prepared by the NIB and Ministry of Water and Irrigation. Marketing of rice is left open to farmers to decide with the MRGM Society and National Cereals and Produce Board (NCPB) as the main players. For credit and financial services, farmers rely on commercial banks and microfinance institutions. General M&O in the scheme is done using funds collected from farmers. Currently, the NIB and the rice farmers' associations run the scheme through the PIM, with all parties involved in different capacities (GoK, 2014).

Management Model Applied in the MRIS

The Participatory Irrigation Management (PIM) model is hinged around developing cooperation and involvement with irrigation farmers in the operation, management and maintenance of the irrigation system at the secondary and tertiary levels through the Water Users Associations (WUA). The WUAs seek to bring together farmers being served by a given infrastructure and act as an interface between the farmers and the irrigation agency towards conflict resolution and cooperation and build synergy among all stakeholders (Kulkarni & Tyagi, 2013). For PIM to be sustainable there is need for: (1) Real participation of farmers which comes from a sense of ownership. (2) Cultural factors, that is, rules of engagement among various stakeholders in water management and agricultural practices

based on the culture of cooperation in the region in terms of past experiences or practices. This is incorporated into the WUA model in terms of physical, administrative and financial aspects. (3) Legal framework of the WUA should be have adequate legal footing and be professionally managed in terms of formal adaptation of PIM policy, status of WUA, rights and duties of its members, relationship between the government irrigation departments and WUA, water rights, ownership and responsibility for maintenance of irrigation infrastructure, conflict resolution and accountability, sources of income, water charges and subsidies. (4) Financial viability, where WUA members should participate economically to cover systems operation management maintenance costs fully by having a strong organization and business plan. (5) Capacity development in cases where WUAs' activities require skills in financial administrative management and backed by technical know-how provided by irrigation engineers working in irrigation departments. In addition, there should be continuous capacity and leadership and training of farmers, WUA officials and irrigation agency staff. (7) Integrated approach, as a response to decentralization of various governmental activities and desired participation of farmers in national and international socio-economic development projects such as, HIV/AIDS, public health, sanitation, Climate Change and educational. By integrating and harmonizing similar functions reduces pressure on farmers' time thus making participation of WUAs in such schemes simpler (Kulkarni & Tyagi, 2013).

In order to ensure sustainability of the MRIS, the NIB and Mwea IWUA have undertaken several measures. (1) Give regular training to rice farmers on water use and maintenance of the system for efficient water use. (2) Carry out regular on maintenance of infrastructure and custody of physical assets under unit leaders. (3) NIB officials hold regular meetings with unit leaders to inform of their needs and agree on what to be done to address them. (4) Rice farmers contribute O&M fee of two thousand shillings per annum. (5) Make improvements in the water canals and replacement of the earth canals with concrete canals. (6) Introduced a

‘ratoon crop’, which is rice grown in-between regular rice crop planting seasons. (7) Introduced a ‘sequencing crop’ in form a legume to replenish the soil nutrients (multi-cropping). (8) Developed an ultimate plan to have a complete Irrigation Management Transfer (IMT), where the rice farmers have complete autonomy in management of MRIS. (9) NIB has secured funding from World Bank for the rehabilitation of the scheme infrastructure. (10) Plans are in advanced stages to construct a dam (a collaboration project between the Government of Kenya and Japan International Cooperation Agency-JICA) with a capacity of 18 million cubic meters by 2018. (11) Ensure that upon completion of this dam, rice farmers can use the extra water for ‘double cropping’ of rice in a year, an additional 20,000 acres of land will be irrigated and increase current annual scheme turnover from 2.5 to 5 billion Kenya Shillings (NIB, 2014).

In MRIS, PIM is applied whereby the NIB manages water in the primary and secondary system divisions, Mwea IWUA manages water at the tertiary system division, Mwea IWUA collects the O&M fees from rice farmers on behalf of NIB, both NIB and MIWUA prepares and implements the annual cropping plans for weeding, planting and harvesting, both NIB and Mwea IWUA manage the cropping programs and both NIB officials and Mwea IWUA unit leaders meet on a monthly basis to plan, strategize and address issues arising from water use in the irrigation scheme. An Agricultural Sub-committee, coordinated by the scheme Manager handles the technical issues consisting of Agricultural Officers and Irrigation Engineers. The Participatory Irrigation Management (PIM) is used in MRIS. It involves developing cooperation and involvement with farmers in the operation, management and maintenance of the irrigation systems at the secondary and tertiary levels through the Mwea IWUA. Thus, PIM seeks to bring together rice farmers being served together by the scheme and act as a link between the rice farmers and NIB, towards building healthy relationships to mitigate conflicts and cultivate synergies among them. The limitations of the PIM include:

boundary rules may not be sufficient to limit the number of appropriators, hence the water needed for efficient allocation is less than the amount available; lack of coordination of water allocation due to the large scale of MIRS which has multiple distribution cycles; supervision is challenging especially in the tertiary section where many rice farmers receive water simultaneously; and the high degree of uncertainty about their water supplies makes rice farmers unwilling to cooperate with the NIB officials.

Although the PIM model applied in MRIS is working well, there are areas of concern especially in the IWUA's responsibility to bring rice farmers and NIB together to ensure cooperation and stakeholder involvement in the management of the scheme. Rice farmers feel distanced from the NIB and that Mwea IWUA does little to build synergy among them. This results in constant conflicts, demonstrations and boycotts of meetings by rice farmers. The large size of the scheme also limits the effectiveness of PIM especially in ensuring efficient and equitable water allocation among farmers and this makes rice farmers uncooperative.

Factors that Affect the Management and Sustainability of MRIS

There are other factors that affect how rules combine with physical and material conditions to generate positive and negative incentives and impact in the management and sustainability of the resource system. In MRIS these are indicated in Table 5.5 below from the highest to the lowest.

Table 5.5: Internal and external factors affecting sustainability of MRIS

Economic

Small, poor and high-cost housing

Water use restrictions to rice production

Farmers' lack of control over their rice product

Regulation against livestock rearing

Low rice prices and subsequent rising poverty

Inadequate research and development of rice seeds

Low rice milling capacity of the MRM which leads to wastage

Low financial working capital available to rice farmers prevalent

Subcontracting services such as tractors is costly and depletes farmers' savings at the society

Social

Land tenure and land pressure

Threats to the family unit (boys over 18 years have to leave the scheme)

Low management skills of farmers' associations officials

Cultural

Discrimination of women from holding farmers' association leadership positions

Few women are issued with licenses to farm in the scheme (preference is given to men)

Environmental

Water pollution (of rivers) due to industrial, agricultural and household activities upstream

Human health risks (water-borne diseases especially Bilharzias and Malaria)

Political

Constant conflicts between NIB and rice farmers in the process of managing the scheme

From Table 5.5 above, respondents gave economic factors as the prevailing in MRIS. The reason being that, most of the rice produced in the scheme is for commercial purposes and therefore, issues to do with prices, marketing, milling, alternative crop production and farm inputs play a major role in the irrigation system. The social, cultural, environment and political factors then follow in that order.

Measures Suggested to Improve the Management and Governance of the MRIS

Table 5.6 shows the suggestions made by rice farmers, Mwea IWUA officials, NIB and other stakeholders on how to improve the irrigation scheme from the most in numbers to the least.

Table 5.6: Measures

State Support

Government of Kenya (GoK) to accelerate the implementation of NBI's two projects targeting the rehabilitation and expansion of the scheme and construction of the dam on River Thiba.

The GoK to marram on-farm roads within the scheme and the out-grower areas.

The GoK to put a check on rice imports to avoid dumping of cheap and substandard varieties.

The GoK to fund NIB to procure surplus rice to stabilize the rice prices as is the case with other cereals.

The GoK to urgently rehabilitate the Mwea Rice Mills aging and broken machines to restore their milling capacity.

Administrative

NIB to continue sensitizing farmers to use certified rice seed from MIRS to ensure higher yields.

Ministry of Agriculture, Livestock and Fisheries to offer adequate support through NIB about extension services, pest and disease control.

Responses on measures to improve management and governance of the MRIS show state support category with the most measures, ranging from rehabilitation and expansion of the scheme to increasing the milling capacity of MRM and marketing and sale of rice produce. Administrative measures focus on advocacy on good crop husbandry in terms of quality seeds and pest and disease control.

5.6 Conclusion

The evolution of the management dynamics over time in MRIS has ensured improvement and efficiency in the use of the irrigation system and enabled rice farmers to overcome governance challenges by incorporating the expertise of other stakeholders. PIM model or style in MRIS management ensures that farmers have a sense of ownership, incorporates cultural practices in agricultural practices and experiences, uses a solid legal framework, financial, economic, business and organizational viability, capacity and leadership development and an integrated approach to rice farmers' participation in various government and non-government activities and projects. Using various stakeholders in MRIS, NIB, rice farmers have overcome two main problems of CPRs, that is, nontrivial exclusion and

substractability of water. The governance structures in MRIS ensure that rice farmers do not experience or are able to overcome appropriation and allocation problems and raise the benefits of low transaction costs and incidences of free riding. By incorporating the rice farmers; their associations and government agencies in creating and enforcing governance structures in MRIS has therefore, yielded extra benefits (economic, socio-cultural, political and environmental) to the rice farmers as members of the associations specifically and the economy in general. Various internal and external factors affect the management and sustainability of the system, ranging from economic (financial and marketing), socio-cultural (community attributes), political (administration and governance) and environmental (size and quality of resource). Rice farmers in MRIS face many challenges but have been able to address and overcome some of them by using their own mechanisms and incorporating the other stakeholders' expertise and counsel.

However, rice farmers, Mwea IWUA, NIB and other stakeholders indicated that the PIM and governance structures applied in MRIS can be strengthened through state agencies and ministries that improve on rice production, crop husbandry and irrigation water management; and government involvement and support in terms of expansion and rehabilitation of the scheme infrastructure, marketing, pricing, and sale of rice produce and expansion of MRM's capacity.

CHAPTER SIX

THE CASE OF LAIKIPIA GROUP GRAZING RANCHES

6.1 Introduction

This chapter outlines the case of Laikipia group grazing lands based on the study's general objective which is to understand the evolution in management dynamics and operation of governance structures in the Common Property Resources (CPRs). The specific objectives are to: (1) Examine the evolution of management dynamics in the group grazing lands over time. (2) Examine the management model used in the group grazing lands and its functioning. (3) Explore the governance structures and challenges of implementing them in the group grazing lands. (4) Explore critical variables related to user groups, institutional arrangements and external environment in the group grazing lands. (5) Suggest measures to improve the management and governance of the group grazing lands.

The study area is Laikipia North District in Laikipia County, Rift Valley Province. This area was chosen because 13 community group grazing ranches representing 7.45% of total county land area are located here. Large-scale commercial, individual ranches and small-scale community group grazing ranches are the main form of land use systems in the county (LWF, 2014). The climate in the area is arid and semi-arid with low mean annual rainfall that averages 400mm per year and occurs in a bi-modal pattern. Consequently, the area experiences cyclic droughts with the most recent ones recorded in the year 2000, 2009 and 2010. The main vegetation is acacia bush land and scattered open grasslands. The soils are generally deep, fertile and well drained but agricultural production is limited by low rainfall. The Ewaso Nyiro River which runs along the Naibunga Conservancy Trust (NCT) is the main drainage system and lifeline of the area (Flintan & Puyo, 2012). The outline of the chapter entails general descriptions of management and governance issues in an irrigation

system as a CPR, background of the Laikipia Group Grazing ranches, data presentation, analysis and discussion, conclusions and recommendations.

6.2 Literature Review

Management in Group Grazing Lands

Ostrom and others (1994) argue that the management design and operational rules in group grazing lands such as, harvesting or investment activities, structure everyday interactions between resource users and the resource system. The resource system in the case of group grazing lands is the pasture and the physical infrastructure that is, the water, fodder troughs, sheds, milking bays, warehouses, insecticide dips and fences. The resource system generates the resource units, which is the grass used as fodder for livestock. That the two focal interactions in the case of group grazing lands are: First, harvesting levels, which is operationalized as the indexed number of livestock grazing on the pasture (appropriation); and second, investment activities, which are operationalized as maintenance of the pasture by communal work and installation of fences (provision). These focal interactions determine the intensity of use and maintenance of pasture, and thus directly affect the economic and ecological state of the resource system.

Further, Ostrom and others (1994) assert that members of the group grazing land prescribe that the rights of usage are attached to the private parcels of the pasture and that they are inalienable but leasable; thus, these members can access, harvest, lease and manage the pastures. Formally, every holder of usage rights can send a specified maximum number of livestock to the pasture because they have usage rights tied to their leasehold or privately-owned parcels. The sum usage rights define the Maximum Sustainable Yield (MSY) of the group grazing land. This property rights system has four functions: the exclusion of non-group members, the assignment of harvesting levels to users in proportion to their land

holdings, the assignment of duties to provide infrastructural investments based on the usage rights one holds and the definition of the MSY for each user (Ostrom, 1994). In Laikipia group grazing ranches, the usage rights enable non-group members to be excluded from accessing the grazing lands, restrict the number of livestock that each member can graze, base harvesting levels to individual proportion of land holdings and requires members to provide infrastructural investments and maintenance services.

Governance in Group Grazing Lands

Stevenson (1991) indicates that there are various primary rights systems used in group grazing lands to limit access by non-group members to grazing areas: (1) Share rights, which limit entry by requiring users to possess grazing rights that is, limit both access to parties who want to enter from outside the group and define grazing pressure rights clearly among users within the group. (2) Community rights, which are grazing areas owned by communities and townships and the requirement for use in residency in the townships or 'citizenship' in the community. Other allocation rules are also used to limit the number of animals, for example, apportioning equal division among applicants, division among township citizens, residents, and non-residents and allocation by rotation or lot. (3) 'Corporate body of citizens', where use is limited to members of families with certain surnames from the old families of the districts in which the corporations are founded. In addition, other restrictions based on residency, wintering of animals in the district and possession of 'hut rights' are imposed. (4) Property rights, which limits entry based on land ownership or tenements in the land. Thus, entry is limited to those who have correspondent property interests in the land and overall use is limited to the carrying capacity of the grazing land (Stephenson, 1991).

Further, Stevenson (1991) argues that to ensure that individuals do not under invest in maintenance and improvements of infrastructure in the group grazing lands, users design and

devise governance structures in the form of regulations, work duties, and fees. These regulations also include the rights system and number of animal units allowed into the pasture and in terms of maintenance, users perform tasks such as weeding, manuring, stone and debris removal and keep their animals in sheds for some hours per day during critical early season to foster initial grass growth. Work duties include the above-mentioned tasks in addition to fence erection, repair and dismantling, path maintenance and building repairs. Users may be required to work for several hours on the pasture for each animal unit grazed or to keep certain items under control, such as weed removal or manuring and the work duty can be discharged by a monetary payment to workers for fulfilling the work obligation. Fees ('grass money') are charged even to those who hold rights to use the pastures to meet administration and improvements costs. To ensure that group members adhere to the rights systems, seasons, regulations, work duties and fees, users utilize compensation fees, fines and the office of the group leader or users' association to provide the requisite compulsion. Even though the number of animals one grazes may exceed the number of rights that the user holds if he/she pays a compensation fees, users are deterred by the fact that these fees become costlier as users add more units beyond their limits. The leader of the group or users' association presides over the users in the performance of their duties by: actively directing the users in the work of pasture improvements, inspecting the pastures to ensure that duties such as weeding have been performed, levy a fine on a user who neglects a duty and check each user's stock of animals against his/her rights (Stephenson, 1991).

In the case of group grazing lands, Stephenson (1991) gives these governance structures as: (1) Position rules which specify the set of positions: appropriator - a grazer and member of users' association, rights holder - holds rights but does not appropriate, provider of infrastructural investment, member of a tribunal (to advocate disputes over appropriation and provision), officials of the association and maintenance of the grazing land. (2) Boundary

rules which define how participants enter or leave these positions: appropriator - must be appropriating during the current season, provider of communal work and fencing, rights holder - must own land in the pasture, provider of infrastructural investment, users' association rules that specify how a grazer becomes a member and the qualifications that individuals must have to be eligible for office positions in the association. (3) Choice or authority rules which specify the set of actions: lease of rights - to or from holder of usage rights, lease of land in the area, provision levels - pay fine instead of providing maintenance services, fencing - pay fine instead of installing fence, delegation of provision to third party and rules of the association specify the actions to be taken by grazers. (4) Information rules which specify information available: standardized measurement of appropriations, reporting of illegal appropriation to higher authority, reporting of provision levels, reporting of fencing levels and rules that specify how information is disseminated to grazers. (5) Aggregation rules which specify the transformation function: agreement on appropriation of external livestock, agreement on movement of livestock within the pasture, collective-action rules proportional to shares, defining levels of provision required reimbursement of additional contribution (fees) and determine the procedure of changing association rules. (6) Payoff rules which specify how benefits and costs are required, permitted or forbidden: setting the interest rates for lease of shares, reimbursement for unused shares, fixed penalty for unreported appropriation, price for appropriating a livestock, fees for under/over provision of maintenance work and fees for fencing. (7) Scope rules which specify the set of outcomes: respecting the Maximum Sustainable Yield (MSY) - appropriation must remain within the determined MSY level and infrastructural investments must serve agricultural purposes (Stephenson, 1991). To ensure harmonious and sustainable interactions between the resource users and resource system, group ranchers in Laikipia group grazing lands have designed and developed user rights and governance structures that regulate resource use. Their

implementation, monitoring, enforcement and sanctioning is done through collaborations among the group ranchers, NCT and other stakeholders who have diverse roles and interests in the group grazing ranches.

6.3 Biophysical and Community Attributes of Laikipia Group Grazing Lands

Arid and Semi-Arid Lands (ASALs) cover approximately 80% of Kenya's total 569,140 square kilometres of land area, with about 14 million inhabitants (35% of the total population of 40 million people). Most ASALs are suitable for extensive livestock production due to weather variability and fragile soil conditions. They support 67% of Kenya's estimated 12.7 million cattle, 86% of the estimated 17.9 million sheep and goats, all camels and most of large wildlife species. Prior to 1900, most natural pastures were used for livestock grazing by various groups of nomadic pastoralists (LWF, 2014). According to the Kenya Open Data, Laikipia County covers an area of 9,462 square kilometres and encompasses a plateau of undulated low hills at elevations between 1500-2600 metres above sea level. It straddles the Equator and lies between latitudes of 0°52N and 0°17S and longitudes 0°37W and 0°36E. From its eastern boundary on the leeward slopes of Mount Kenya (5199 metres above sea level), it stretches South West to the slopes of Nyandarua or Aberdare Ranges with Mount Sitima (3,996 metres above sea level) as its highest peak and West to the Rift Valley escarpment and to the arid plain in the North.

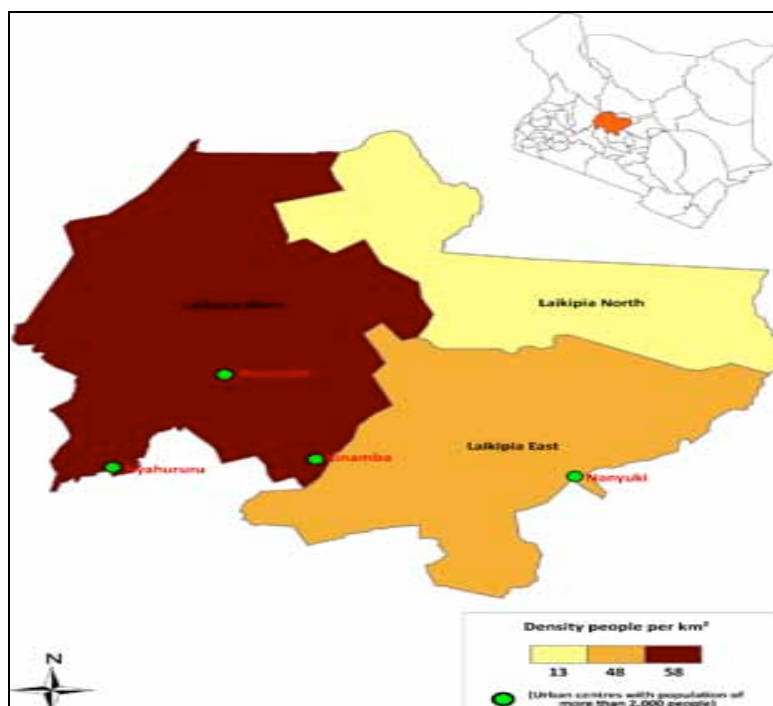
Annual rainfall patterns are bimodal with long in April to May accounting for 80% of total annual rainfall and short rains in October to November. However, rain is generally erratic and it may fall any time of the year. Both Nyandarua Ranges and Mount Kenya exert a strong influence on rainfall distribution, ranging from between 750 and 900 mm in southern to 300mm in northern parts. Precipitation also varies in duration along the same gradient. Daily temperatures vary with altitude and season; with mean temperatures of 24°C and mean

minimum and maximum are 10° and 35° respectively. The spatial-temporal distribution and intensity of precipitation is a key variable that influences the agro-ecological potentials of the area. Most of the county falls within the semi-arid and arid agro-ecological zones, with small areas on the foot slopes of the mountains classed as sub-humid (Roden, Berymann & Nusser, 2014). Flood phonolite lavas of Miocene age form the predominant geology of Laikipia County. Evapotranspiration is intense and moisture deficits are experienced widely. It has a gradient of declining levels of annual precipitation, with average rainfall levels of 500mm to 700mm in the South West and 300mm to 500mm in the central and north-eastern parts. Vegetation cover reflects levels of precipitation and human modification, mainly Acacia bush lands and fire-adapted grasslands. In most cases, grasslands are anthropogenic and a product of higher intensities of human activities (burning, overgrazing and charcoal burning) and grazing pressures. Large livestock and game ranches and densely settled areas of communal farmland characterise the county. With high variability and unreliability of rainfall and declining water resources coupled with worsening problems of land degradation and high erodibility of soils; local actors in the area face harsh ecological conditions. In the dry areas, land use is pastoral range lands, large ranches, tourist lodges and game parks. The growing number of water abstractions for irrigation, livestock and domestic purposes has led to growing competition for this scarce natural resource (Ulrich et al, 2012).

It has a total population of 399,227 and a population density of 42 per square kilometre, with 46 per cent of the population living below the poverty line. The settlement patterns in the county are dictated upon by the potentiality of land, land use system and water availability. The lives and livelihoods of pastoralists, ranchers, small hold farmers, and tourism operators are inextricably intertwined with productivity, intensity and sustainability of the abundant natural resources. The main features of Laikipia County include natural resources such as, arable soils, ranches, forests, wildlife, rivers; tourist attractions such as, Mount Kenya, Ole

Pejeta Conservancy, Laikipia Plateau Reserve, Thompson Falls, Caves, largest Military Air Base (also used by British Army to train); and economic activities such as, horticulture, mixed farming, and livestock farming (Kenya Open Data, 2014). The large scale of the Laikipia group grazing lands is reflected in terms of: (1) the geographical size - the 13 community group ranches located in Mukogondo Division of Laikipia North District in Laikipia County occupies 1,178.7 square kilometres of land area, approximately, 7.45% of the total Laikipia County land area of 9,462 square kilometres. (2) the number of users or group ranchers, the total population of Mukogondo Division is 17, 154 people, approximately 4.30% of the total Laikipia County population of 399,227 people (Kenya Open Data, 2014). Figure 6.1 below show the map of Laikipia County.

Figure 6.1: Laikipia County



Source: Google Maps

6.4 Methodology

The study adopts a Qualitative Research (QR) methodology and was conducted using a survey research design at a group level which in this case are the group ranchers in Laikipia

County who are members of the 13-small scale group grazing ranches. They enjoy all property rights in the group ranch and who own and graze a given number of livestock in the ranch and uses other facilities (water, dip, sheds, feeding troughs) provided therein. The target population comprise (1) officials of the 9 group grazing ranches under Naibunga Conservancy Trust in Laikipia North district. (2) Representatives of Community Based Organizations (CBOs), government organizations, ministries and agencies, educational and research institutions, environmental conservation organizations, financial institutions, media and telecommunication organizations, religious organizations, Non-Governmental Organizations (NGOs) and United Nations agencies in Laikipia County working with the group ranchers. The sampling process involved identifying the group grazing ranchers' association (Naibunga Conservancy Trust) and specific organizations working in Laikipia group grazing lands. Primary data was collected using structured interview guides addressed to the target population, informal face-to-face discussions between the target population and the researcher and general observation of community behaviour by the researcher. Secondary data was sourced from Government of Kenya electronic data base - Kenya Open Data, Government of Kenya relevant documents that is, the Constitution, National Land Policy, and the Environmental Management and Coordination Act (EMCA), 1999. The researcher also sourced additional information from various publications by the above organizations, their data bases and other literature on the economic, socio-cultural, political and environmental issues in CPR management.

6.4 Data Presentation, Analysis and Discussion

Total Sample

The total sample number selected for interview comprised of 9 group grazing ranches under the umbrella association Naibunga Conservancy Trust (NCT), in Mukogondo Division of Laikipia North District in Laikipia County, these are Koiya, Imotiok, Tie Mamut, Kijabe,

Nkoloriti, Musul, Ilpolei, Munishoi and Mampusi. Manager NCT, 9 group ranchers and 1 representative of: Northern Rangelands Trust (NRT), African Wildlife Foundation (AWF), Laikipia Wildlife Forum (LWF), National Environmental Management Authority (NEMA), Kenya Wildlife Services (KWS), Department of Livestock Production, Department of Livestock Veterinary Development, Water Resource Management Authority, Centre for Training and Integrated Research for ASALs Development (CETRAD), Mpala Livestock Research Institute, Nasaroni Financial Services Organization, World Vision, Religious Organizations and private large scale commercial ranch.

Table 6.1: Total Sample

Respondents	Number
Group Ranches Officials	9
Group Ranchers	9
Manager NCT	1
NRT	1
AWF	1
LWF	1
KWS	1
NEMA	1
Department of Livestock Production	1
Department of Livestock Veterinary Development	1
CETRAD	1
Mpala Livestock Research Institute	1
Nasaroni Financial Services Organization	1
World Vision	1
Religious Organizations	1
Private large scale commercial ranch	1

Role of Naibunga Conservancy Trust in Laikipia group grazing lands

The group ranchers in the NCT comprise of the Mukogondo Maasai ethnic group and land tenure and ownership is in form of group ranches with or without individual titles as shown in Table 6.2 below.

Table 6.2: NCT Background Information

Name of group ranch
Koija, Imotiok, Tie Mamut, Kijabe, Nkoloriti, Musul, Ilpolei, Munishoi, and Mampusi
Ethnicity
Mukogondo Maasai
Main Livelihood
Agro-pastoralist and tourism
Population
Approximately 12,000 people
Land tenure/ownership
Group ranches with and without title
Total area
47,740 hectares

The NCT was established in 2001-3 with assistance from the Laikipia Wildlife Forum (LWF) and the African Wildlife Foundation (AWF). It is a partnership of nine group ranches located in West Mukogondo District, Laikipia North District in Laikipia County. ‘Naibunga’ is a Maasai word which means ‘connectedness’ or ‘collective responsibility’. The ranches under the conservancy and its boundary are not fenced to allow free movement of wildlife across the ranches and in/out of neighbouring conservation areas. Some of the group ranches are yet to obtain title deeds for their land. NCT is a founder member and one of the fifteen conservancies that in 2004 formed the umbrella organization, the Northern Rangelands Trust (NRT). With the assistance from NRT: (1) NCT fundraises for its staff. (2) Offers capacity building training for conservancy board members, manager, rangers and women’s income-generating groups. (3) Is involved in introducing new approaches to the group ranches such as grazing practices in form of holistic management. (4) Assists communities to obtain formal title land deeds to their group ranches. (5) Provides an important corridor for wildlife movement between private conservancies and ranches that are heavily fenced. (6) Works with and received the support of World Vision Kenya and neighbouring private commercial ranches. (7) The Conservancy Board approves all decisions on strategies, approaches and

activities taken by member group ranches. (8) Presides Conservancy Board meetings which are held regularly or as need arises. (9) Holds an annual General Meeting with the Conservancy Board and additional representatives from the member group ranches. (10) Receives and approves financial and progress reports, which may also be made available to the LWF and AWF if need be, based on the nature of the assistance they have offered (Flintan & Puyo, 2012).

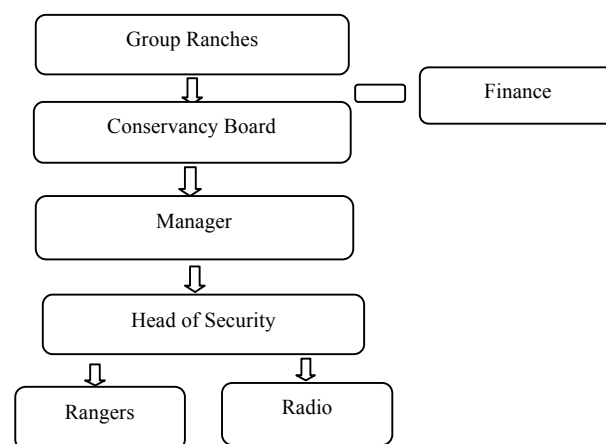
The NCT's vision is 'to become a unifying factor for pastoral communities and lead promoter of sustainable tourism in Laikipia North District'. Its mission is 'to conserve the integrity of Laikipia North District ecosystem and enhance the Maasai cultural heritage while promoting entrepreneurial culture among the community and other stakeholders, exploit natural resources and turn them into nature-based enterprise that can benefit diverse interests of the community and create social cohesion'. The NCT has three general guiding objectives: biodiversity conservation, income generation for livelihoods support and poverty alleviation and environmental management and conservation. Its specific objectives are to: strengthen security in the larger Naibunga, help in the management of natural resources, harmonize enterprise development, fundraise for the development of the member group ranches, market Naibunga community initiatives and build capacity and enhancement of member group ranches (Flintan & Puyo).

Structure and Membership of NCT

Each of the nine-member group ranches of NCT has a five-member Grazing Committee comprising of the Chairperson, Vice Chairperson, Secretary, Vice Secretary and Treasurer. The committee oversees compliance to the grazing zoning and seasonal plans, oversees infrastructural development and loan repayments, enforcing grazing quotas and grazing management and maintaining the integrity of the group ranch boundary. It is backed up by

the by-laws enacted by the group ranchers and the authority and blessings of community council of Elders. A team made up of a Manager, security staff and Conservancy Board which consists of 18 members including the Chairperson and trustees from each member group ranch manages the Conservancy. The Chairperson and trustees are elected annually by the group ranch members, and can be re-elected for many successive years.

Figure 6.2: NCT Management Structure



Source: Naibunga Conservation Trust, 2014

Other stakeholders and their role in Laikipia group grazing lands

The group ranchers, group ranch officials and NCT in performing its functions consults and cooperates with local (now County) government, relevant agencies of central government and lead agencies.

Northern Rangelands Trust (NRT)

Develops resilient community conservancies to transform people's lives, secure peace and conserve natural resources. Helps in setting up democratic management structures for conservancies, raise funds for the conservancies, helps with logistical operations and supports livelihoods in surrounding community conservancies. Provides advice on how to manage their institutional arrangements and financial issues and supports a wide range of training

activities on a need basis. Helps broker agreements between the conservancies and investors such as, setting up tourist lodges and monitors their performance thereby providing donors and conservancies with a degree of oversight and quality assurance.

African Wildlife Foundation (AWF)

An international conservation organization that focuses on Africa in various projects. They include: wildlife conservation, land and habitat protection, community empowerment and economic development, offers a combination of land management, conservation enterprise, capacity building and training, applied ecology and policy level conservation strategy, assists communities in developing alternative and sustainable enterprises as a source of income while conserving natural habitats.

Laikipia Wildlife Forum (LWF)

This is a dynamic, membership led conservation organization supporting, coordinating and facilitating pan-Laikipia led conservation and natural resource management. Specifically, on wildlife conservation and management, environmental education and literacy, rangeland, rehabilitation and management, tourism sector support, water resources management, forest management, conservation enterprise development and peace and security.

National Environmental Management Authority (NEMA)

Mandated by the government to offer environmental protection, conservation and public environmental education. It develops and designs governance structures and by laws through stakeholders' participation forums with group ranchers. Oversees the signing of agreements by group ranchers to abide by the governance rules and by laws. Undertakes regular monitoring and evaluation of the group ranches to ensure that ranchers adhere to actions as stipulated in the signed agreements.

Kenya Wildlife Services (KWS)

It has the stewardship of National Parks and Reserves in Kenya. Oversees wildlife conservation and management outside protected areas. Offers conservation education and training and carries out wildlife research. Gives input into national wildlife related law, policy and adopts international conservations and protocols.

Department of Livestock

Offers capacity building in the management of livestock farming to avoid overstocking. Marketing of livestock by streamlining, sourcing and connecting group ranchers to markets. Offers training on range management to avoid overgrazing. Encourages group ranchers to sell excess livestock and carries out routine livestock management programs such as, feeding and disease control. Organize learning and exposure trips for ranchers to other parts of the country practicing similar livestock farming methods. Offers training on value addition in collaboration with private large-scale commercial ranches, World Vision, African Wildlife Forum, SNV Netherlands Development Organization, Laikipia Wildlife Forum and Kenya Wildlife Services. Offers holistic range management through Laikipia Wildlife Forum. Initiates the formation of a livestock marketing association through county government to market livestock and livestock products for group ranchers. Offers water resources management services in terms of monitoring and advice in its use through the National Drought Management Authority (NDMA) and by providing boreholes and water trucks. Encourages group ranchers to diversify farming activities by incorporating beekeeping, poultry farming and gum harvesting from the Acacia tree for income generation. Facilitates issuance of trade licenses and permits to group ranchers. Certifies livestock for movement to local and international markets.

Department of Veterinary Production and Development

Facilitates livestock disease control and surveillance activities. Offers dips, inoculation, immunization and transmission veterinary services. Negotiates with Government of Kenya on behalf of group ranchers for regular free veterinary services. Offers quality assurance services such as hygienic slaughter houses and meat inspection. Arbitrates disputes among group ranchers and offers social development and conflict resolution services. Engages with various partners on behalf of group ranchers to prepare development project proposals and draw contracts. Offers training on hide and skin preservation and livestock sale. Gives Climate Change advice and mitigation services to group ranchers in collaboration with partner organizations such as, German Technical Cooperation Agency (GTZ), Food and Agriculture Organization (FAO), AWF, World Vision and Centre for Training and Integrated Research for ASALs Development (CETRAD).

Water Resource Management Authority (WRMA)

A state corporation under the Ministry of Environment, Water and Natural Resources is charged with being the lead agency in water resources management with powers to: Develop principles, guidelines and procedures for allocation of water resources and monitor and regularly reassess the water resources management strategy. Receive, determine applications, monitor and enforce conditions attached to permits for water use. Regulate, protect water resources quality from adverse impacts, manage and protect water catchments. In accordance with guidelines in national water resources management strategy, determine charges to be imposed for the use water from any water source. Gather and maintain information on water resources and regularly publish forecasts, projections and information on water resources. Liaise with other bodies for better regulation and management of water resources. Advice the Ministry concerning any matter relating to water resources.

Centre for Training and Integrated Research for ASALs Development (CETRAD)

This organization carries out research and training in Environmental Impact Assessment, food security, forest management, integrated water management, pastoralist farming and innovations to help communities improve livelihoods. Through Eastern and Southern Africa partnerships, implements outreach projects which include applying past research findings in water, land and natural resources management through the Constituency Development Fund. Initiates the formation of a water users' association which the group ranchers are part of stakeholders and members. Carries out community mobilization to organize and coordinate activities in natural resource management to mitigate resource use conflicts. Offers advocacy with the Government of Kenya on behalf of the group ranchers to give their opinions on issues affecting them in natural resource use and management.

Private large-scale commercial ranches

Allows the group ranchers access to their ranches in times of droughts to graze and water their livestock.

Mpala Livestock Research Institute (MLRI)

Carries out research that is useful for the group ranchers in the field of Zoology, Insects and Botany.

Nasaroni Financial Services Organization

Offers financials advice, training and services to group ranchers such as, credit facilities and saving schemes.

Religious Organizations and Donors

They offer spiritual guidance, social amenities and economic infrastructures such as, schools, clinics/dispensaries, roads, boreholes, bridges and education bursaries for needy students.

World Vision

Offers various development intervention programs focusing on environment, Christian commitments, protection (including Child Rights), gender, conflict prevention and peace-building, food security, economic empowerment (small scale enterprises) education, health, HIV/AIDS, Water, Sanitation and Hygiene (WASH), public policy advocacy, Human Emergency Response and nutrition.

These stakeholders in the group grazing lands operate very closely with the group ranchers especially the Department of Livestock in issues of animal husbandry; environmental management and conservation programs undertaken by various NGOs and KWS; water resource management through the WRMA of the Ministry of Environment, Water and Natural Resources; and Zoology, insects and Botany research services done by MLRI. The group ranchers expressed their gratitude to these organizations especially the religious and financial that address their other needs in form of socio-economic amenities, services and infrastructure. Similarly, they were full of praise for the private large scale commercial ranches which allow them (group ranchers) access into their ranches to graze livestock during drought periods.

Governance Structures applied by Ranchers in Laikipia Group Grazing Lands

Various governance structures are developed, designed and applied by group ranchers, NCT and other stakeholders in their daily operations in Laikipia group grazing lands in terms of appropriation and provision. These are indicated in Table 6.3 and figures 6.3, 6.4 and 6.5 below.

Table 6.3: Governance Structures

GOVERNANCE STRUCTURES	Group Ranches	Group Ranches%	NC T
Position rules:			
A group rancher should be a member of a group ranchers' association	18	100	1
Appointment of officials of the group ranchers' association	18	100	1
A group rancher can hold rights but does not graze in the Laikipia group ranches	18	100	1
A group rancher provides infrastructural investment (money contributions)	18	100	1
A group rancher performs maintenance tasks (weeding, fencing, building repairs, etc.)	18	100	1
Appointment of a tribunal to settle disputes among group ranchers	0	0	0
Boundary rules			
A group rancher is required to reside within the area	18	100	1
A group rancher must own land in the Laikipia group ranches	18	100	1
A group rancher must graze livestock only in the current season	18	100	1
Specified procedure on how a group rancher becomes a member of association	18	100	1
Specifies qualifications for a group rancher to be an official of the association	18	100	1
Choice or authority rules			
Specifies who can lease land in the Laikipia group ranches	18	100	1
A group rancher may ask someone else to perform maintenance tasks on their behalf	0	0	0
A group rancher may pay a monetary fine instead of providing maintenance services	0	0	0
A group rancher may pay a monetary fine instead of installing fence	0	0	0
Specified actions to be taken in case a group rancher violates an agreed upon rule	18	100	1
Aggregation rules			
Agreement on grazing of external livestock in the Laikipia group ranches	18	100	1
Agreement on movement of livestock within the Laikipia group ranches	18	100	1
Agreement on maintenance tasks contribution according to number of their shares	18	100	1
Set levels of maintenance tasks required of each group rancher	18	100	1
Determine the procedure of reimbursing a group rancher's excess infrastructural investment fees contributions	0	0	0
A set procedure for changing group ranchers' association rules	18	100	1
Information rules			
Fixed number of livestock a group rancher can graze in the Laikipia group ranches at a period	18	100	1
A group rancher to report any illegal grazing observed to higher authority	18	100	1
A group rancher to report maintenance tasks they perform	18	100	1
A group rancher to report or record any fencing they undertake	0	0	0
Set procedures of passing all important information to group ranchers	18	100	1
Payoff rules			
Set interest rate for leasing of shares in the Laikipia group ranches	0	0	0
Fixed penalty fees for unreported grazing in the Laikipia group ranches	18	100	1
Reimburse a group rancher for unused shares in the Laikipia group ranches	0	0	0
Set price for grazing a unit of livestock in the Laikipia group ranches	0	0	0
Set fees for not performing maintenance tasks	18	100	1
Set fees for fencing the Laikipia group ranches	18	100	1
Scope rules			
A group rancher must graze only the number of livestock in the Laikipia group ranches	18	100	1
All infrastructural investments made must be to improve the Laikipia group ranches	18	100	1

Figure 6.3: Choice/authority rules

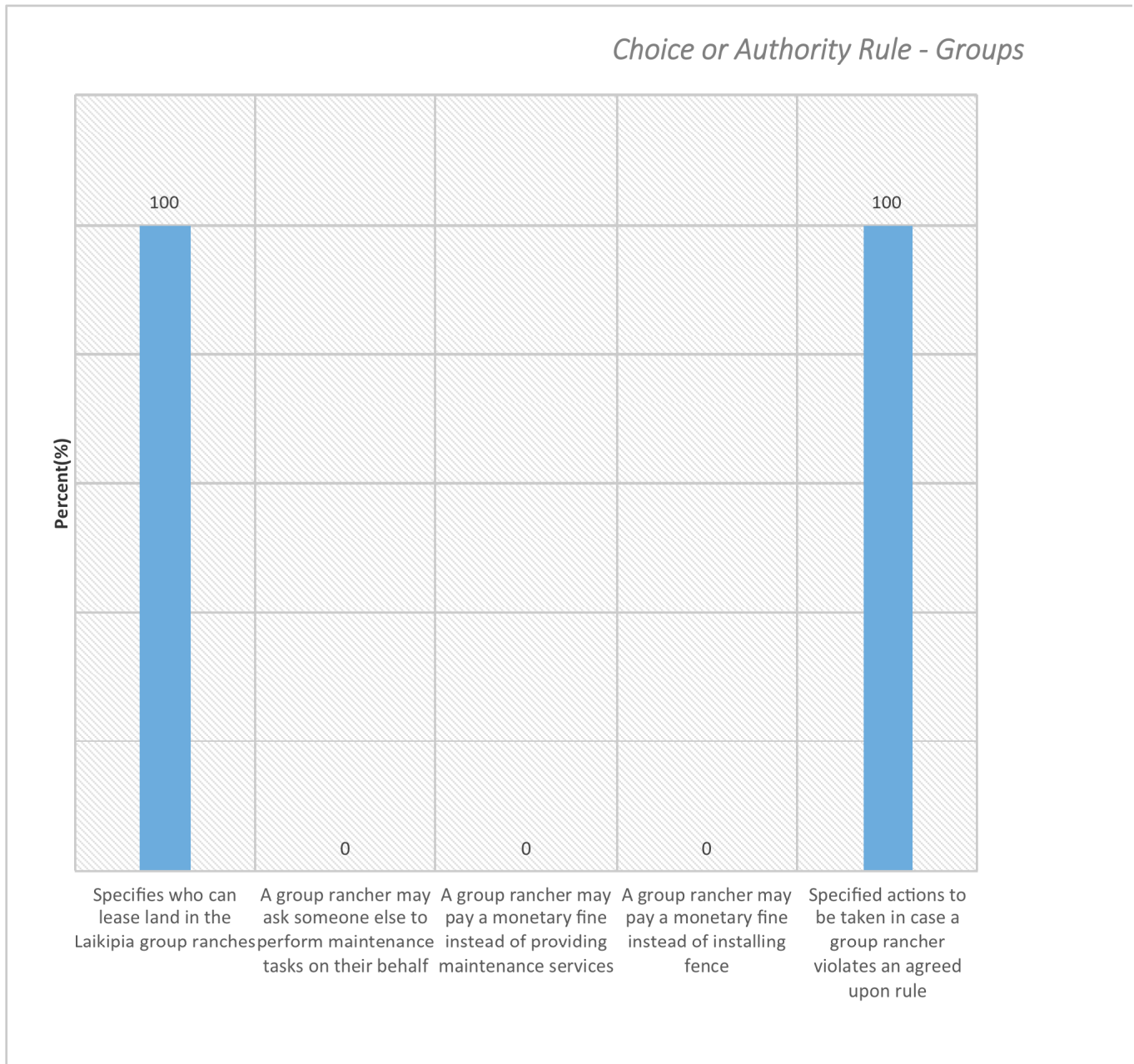


Figure 6.4: Aggregation rules

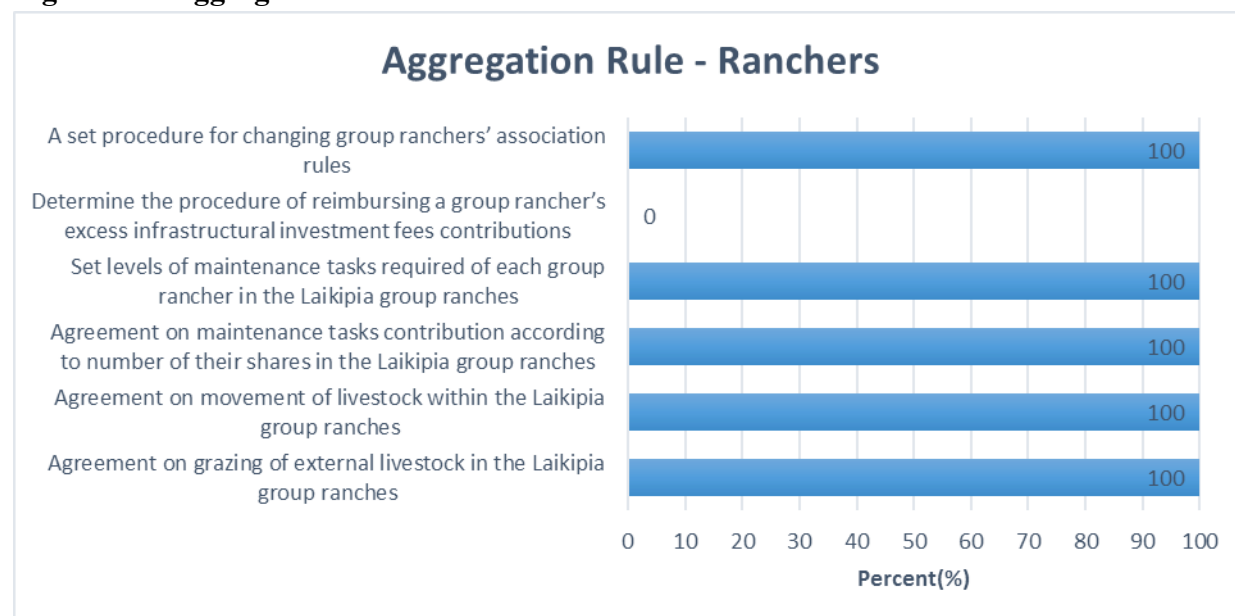
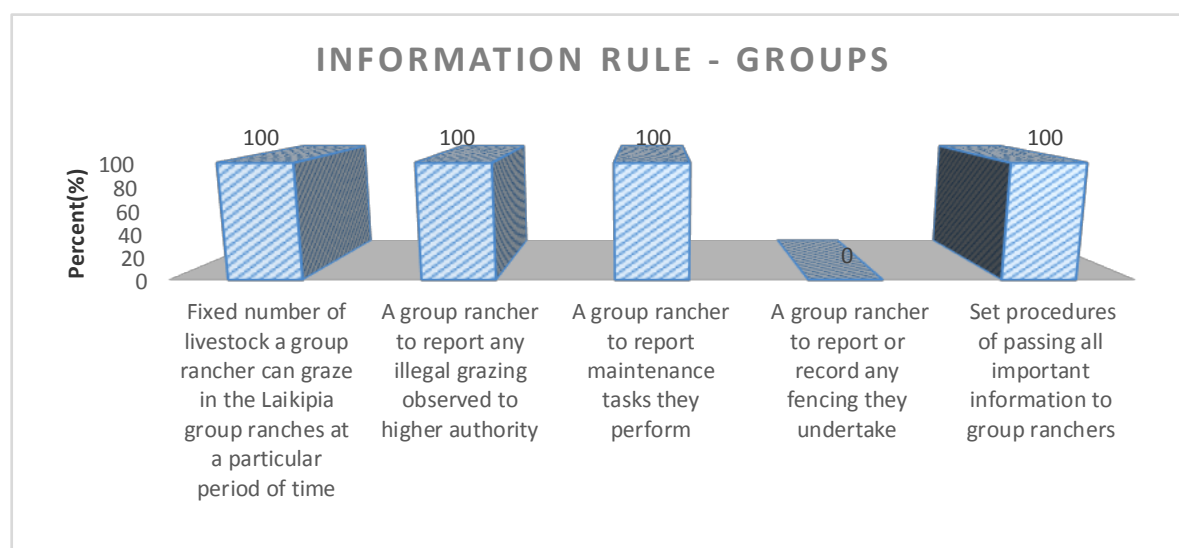


Figure 6.5: Information rules



Respondents indicated that position, boundary, information and scope rules are the most used in the Laikipia group grazing lands. The reason being that majority of these rules are contained in the group grazing by-laws of each of the 9 group ranches under the NCT umbrella. Thus, group ranches are more familiar with them and apply them on a daily basis. Position rule to appoint a tribunal to settle disputes is not applied (0/18 or 0%) because dispute and conflict resolution is done on a 'need-basis' and depends on the nature of dispute or conflict and parties involved. A tribunal is constituted by NCT and other stakeholders to

address the matter and there after disbanded. Most of the choice or authority and pay-off rules are formulated by NCT and therefore implementation, enforcement and monitoring is done by the 9-group ranch and NCT officials. Choice or authority rules to ask someone else to perform maintenance services or pay a monetary fine instead of providing maintenance services and pay a monetary fine instead of installing fence; aggregation rule of a set procedure to reimburse a group rancher excess infrastructural investment fees contributions; and information rule to report or record or record any fencing undertaken are all not applied (0/18 or 0%) because there is no monetary attached to maintenance services and fencing. These maintenance services or activities which include clearing of paths, erecting gates, cleaning of water troughs and repairing cow and calf sheds or pens are undertaken in a communal rather than on an individual group rancher basis. Fencing which entails erecting group ranch boundaries, wildlife corridors and external perimeter fence to enclose all nine group ranches are undertaken by NCT. Pay off rules to set interest rate for leasing shares, reimbursement of unused shares and set price for grazing a unit of livestock in the group ranches are not applied (0/18 or 0%) because this is prohibited in the Land Act, CAP 287.

Although the governance structures used in Laikipia group grazing lands are guided by the provisions of the Land Act, CAP 287, many other factors should be considered and incorporated for them to be effective. In the Maasai culture and tradition, all grazing lands and livestock belong to them therefore, to subdivide land into parcels (group ranches) and lease it out to non-Maasai creates tensions, conflicts and non-compliance among group ranchers. Similarly, livestock movement is not supposed to be restricted by erecting fences around group ranches and this free and unrestricted loaming and grazing of animals make it difficult to adhere to scope rules that require livestock not to graze in certain sections of the ranches for a given time. Some group ranchers take advantage of the large scale of the grazing lands and fail to observe aggregation rules that require them to agree on maintenance

tasks to be performed or grazing of external livestock. The NCT tries to ensure cooperation by group ranchers by including other stakeholders such as, NEMA in their meetings and deliberations with group ranchers regarding enforcement and monitoring of rules.

Phases of Governance Structures

Various stakeholders are involved in the creation and implementation of governance structures in Laikipia group grazing lands, but the overall guiding principle is the provisions of the Land Act, CAP 287 of the Land Laws of Kenya. These provisions are the legal basis for establishment of a group ranch as an institution in terms of ownership and occupation of land by a group of people. The Minister of Agriculture, Livestock and Fisheries appoints a Registrar of group representatives to perform administrative duties and exercise the powers imposed and conferred to the registrar by the Act. The group ranchers adopt a Constitution or rules of the group and elect officers/representatives of the group. The Constitution stipulates the qualifications of/disqualifications from office. The Registrar issues a certificate of incorporation of group representatives to officers/representatives, which is a binding obligation upon them to observe. Offenses of non-compliance and penalties applicable are spelt out and any person found guilty of an offense under this for which no penalty is expressly provided, is liable to a fine not exceeding five thousand shillings or imprisonment for a term not exceeding six months or both.

Challenges that Group Ranchers, NCT and Stakeholders Face

Group ranchers, NCT and other stakeholders indicated the numerous challenges they face in their daily operations in the Laikipia group grazing lands which threaten land management, community livelihoods, and sustainability of natural resources. The challenges vary in terms of the specific group facing them as indicted in Table 6.4 below from the most to the least.

Table 6.4: Challenges

Unequal distribution of benefits from the NCT among all member group ranches

Growing resentment and conflict because of poor management
Lack of accountability in the distribution of benefits
Majority of benefits accrue directly to the overall NCT
A few individuals who are more active in non-livestock income generating activities receive most benefits
Little financial impact to the community from non-livestock income generating activities
Group ranchers feel that their grazing lands are being more strictly controlled by NCT's interventions
Destruction of vegetation and property, injury and/or death of people and livestock by wildlife
Increasing threat to the main livelihood system (extensive livestock production)
Loss of access to resources due to privatization of lands
Breakdown of traditional communal management systems and reduced capacity to cope with drought
Non-marketed animal products such as hides and milk

Complexities of many donors and organizations working with group ranches

Problems of coordinating and duplication of efforts
Inefficient and ineffective expenditure of funds
Inability to cultivate, ensure and maintain good relations among the various stakeholders in the group ranches
Collapsed donor funded honey project due to poor access to markets
Mismanagement and internal conflicts among the ethnic clans
Limited livestock services available such as, dips, veterinary services and abattoirs

Developing the linkages between conservation and development

Failure of integrated conservation and development projects
Lack of secure rights to land (inequitable land redistributions during and post-colonial periods leading to marginalization of the local land users)
Failure to realize sufficient benefits that are equitably distributed to all community members
Poor resource governance structures leading to general inability to exploit available natural resources
Livelihood options are limited due to the climate (arid and semi-arid)
Beekeeping, wildlife tourism and gum tapping are the other alternative sources of livelihood

Poor basic socio-economic indicators

A large percentage of the population depend on relief food
High illiteracy levels - less than half of school going children are in school
High infant mortality rates
Poor infrastructural and telecommunications services development
Rapid economic development and modern infrastructures that threaten the community's way of life

Poor supporting policy for wildlife-based investments

Lack of policies of ownership and control by communities over wildlife
Outdated policies on compensation of human and livestock loss by wildlife
Rigid policies over shooting or killing of wildlife
Rising human/wildlife/livestock conflicts due to wildlife predation and competition for water and grazing pastures

Threats from droughts and Climate Change risks

Loss of livestock
Greater encroachment into the NCT by neighbouring pastoralist groups in search of pasture and water
Poor livestock breeds which make them vulnerable to droughts and diseases

Poor coordination various of group ranches

Different actors are involved who have different priorities and activities
Conflict of interest among the group ranches as part of a collective group Conservancy on the one hand, and on the other an individual unit with a mandate to prioritize the needs of its members

High human population growth

Stretched out land use activities
Increased competition for natural resources

The highest number of challenges given by respondents fall under the unequal distribution of benefits from NCT among all member group ranches because the group ranchers are the ones

experiencing most of them. Complexities of large number of donors and organizations working with group ranchers and developing linkages between conservation and development follow as given by other stakeholders with diverse interests and roles in the Laikipia group grazing lands in terms of harmonization and coordination of activities. Lastly, poor socio-economic indicators, poor supporting policy for wildlife-based investments and threats from droughts and Climate Change risks which reflects on general underdevelopment in Laikipia County and the severe weather and terrain of ASALs.

Evolution in Management Dynamics in the Laikipia Group Grazing Lands

According to NCT (2014), prior to the colonial period, the Laikipia Plateau was inhabited by mainly Maasai. Over centuries, these pastoralist communities had crafted institutions and practices that enabled them to survive in the area. They managed pastures communally and grazed individually-owned livestock extensively, which involved the seasonal movement of people and livestock. These management systems were regulated by the availability of water and good pastures, presence of diseases along nomadic routes, prevailing security situation and timing of important socio-cultural activities. In the early 20th Century, treaties between the British and Maasai resulted in the movement of most of the Maasai out of the area to make way for the establishment of large-scale commercial livestock ranches for White Settlers. After independence (1963) these ranches were retained as part of the then President Jomo Kenyatta administration and colonial government agreement. Some White Settlers opted to sell their land to the Kenyatta administration, which in turn settled Kikuyus from Central Province in them as land buying companies. Most did not settle in Laikipia but used the land as collateral for accessing bank loans and became absentee landlords. Most of the land was later divided into group ranches to settle Maasai pastoralists under the World Bank's Rangeland Development Programme. The remainder was registered as government land or 'outspans' (Letai, 2011). Group ranches allowed a group of pastoralists to jointly own

and manage land. Unfortunately, group ranches failed to achieve their objectives of commercializing production, improving pastoral wellbeing and improving environmental management. This land use management system was maintained up to the late 1990s when agitation for land reforms under the new constitution began. A new pattern of land ownership and management emerged with either the initial patterns changing hands or its initial plans altered. Much of the government land (outspans) was grabbed by senior government officials, politicians and military officers. Although some Maasai elites acquired large land holdings, most Maasai continued to live on group ranches in West Mukogondo Division, with few changes on land ownership and use (NCT, 2014).

World Resources Institute (2014) indicate that colonialism brought many changes to pastoralists' way of life. In the late 1980s and early 1900, the British settled pastoralists to politically pacify them and maintain law and order. The Crown Lands Ordinances of 1901 and 1902 declared all land in Kenya to be 'Crown Land' belonging to the Queen of England, and authorized the British High Commissioner to Kenya, to evict Africans from their traditional lands, confine them in 'native reserves' and allocate their former lands to British settlers for commercial livestock and crop production. This alienation of land and creation of protected areas for wildlife conservation deprived many pastoralists of land. In 1939, the British passed the Trust Land Act, which governed land that was occupied by Africans and had not been registered in individual or group names or declared government land. The boundaries of native reserves were made with no regard to seasonal variations and their need to move their livestock to water and green pastures. They also undermined the marketing and trade networks that had previously existed between pastoralists and neighbouring agriculturalists. The British further isolated local livestock breeds and discouraged pastoralism through punitive quarantine regulations that confined cattle to areas. This caused overstocking which lead to overgrazing and declining pasture conditions, especially after the

1933 and 1934 droughts (World Resources Institute, 2011). The British ordered pastoralists to destock their livestock but the measure provoked considerable local and political dissent, and was abandoned. In 1945, the African Resettlement Board (ARB) was created to address land degradation but was later taken over by the African Land Development Unit (ALDEV), charged with the implementing the Ten-Year Development Plan (1946-55), which had much wider and inclusive objectives.

Pastoralists were organized to occupy large grazing schemes and received support from government projects such as Tsetse Fly eradication, locust control, and vaccination against Rinderpest virus, soil conservation, afforestation, boreholes, dam/water pans construction and small-scale irrigation. Marketing was developed and stock routes established between pastoralists areas and urban centres. In 1955, the 'Swynnerton Plan for the Reform of African Land Tenure' established a new land-use policy. The policy sought to formalize land rights of African farmers in high potential agricultural areas and support communal grazing in pastoral areas. In pastoral areas, the policy aimed to reduce livestock numbers, avoid overuse of vegetation, limit soil erosion and realize reasonable annual take-offs. It identified five conditions for sound productive use of rangelands: stock numbers limited to the carrying capacity of the land, regular outlets to absorb excess stock, construction of permanent water supplies, controlled grazing and grazing areas managed at a productive level and eradication of tsetse fly, which infected cattle with Trypanosomiasis (sleeping sickness). To implement the policy, the British launched 40 grazing schemes in various districts including Mukogondo in Laikipia, with a livestock officer attached in each scheme. By 1960s, however, many of these grazing schemes failed and were abandoned, mainly because restrictions on the movement of animals proved difficult, given the unreliability of rainfall and variability of grazing pastures (World Resources Institute, 2011).

Following the severe drought and subsequent floods of 1961-1962, concern over the ASALs grew. At independence in 1963, Trust Land was vested in county councils which had power to hold and alienate land for the benefit of persons ordinarily resident on land. Subsequently, the Land Adjudication Act was passed, which came into force in 1968 and was designed to enable the ascertainment and recording of rights and interests in Trust Land to ensure that not only were individuals and families recorded and registered as land owners, but groups as well. The Rangeland Management Division in the Ministry of Agriculture was then established to upgrade the range economy by conserving, managing and developing the ASALs. In 1965, the government commissioned an inquiry into 'Land Consolidation and Registration in Kenya, 1965-1966'. Known as the Lawrence Report, it concluded that the group registration had greater relevance to range areas, land rights in Maasai land range areas were communal, proposed appointing group representatives to deal with the land and enable direct adjudication of private permanent rights to groups. This report was the official basis for the establishment of 'group ranches' as a principle organizational structure for the development of traditional pastoral areas, especially the Maasai districts (World Resources Institute, 2011).

In 1968, the government passed the Land Group Representatives Act, which legalized the ownership and occupation of land by a group of people and provided the legal basis for the establishment of group ranches. A group ranch is a legally recognized institution formed under Cap 287 of this Act. It encompasses a large tract of land that is delineated and registered, and which is owned privately by the group (registered under the Land Adjudication Act-Cap.284) and used equally by the group members. Pastoralists' communal land use and livestock movement within the group ranch boundary is permitted. Thus, a group ranch is a livestock production system or enterprise where a group of people jointly own freehold title to land, maintain agreed stocking levels and herd their livestock

collectively which they own individually (Flintan & Puyo, 2012). Overtime, these changes in land ownership and use patterns has led to a huge rush for land in Laikipia County, with new patterns and differentials emerging. There are 48 large-scale commercial private ranches, representing 40.3% and 13 group ranches, representing 7.45% of the total land area in the county. The group ranches are occupied by pastoralists who use them for communal grazing. It was hoped that by tying people to fixed land areas would settle pastoralists, raise their awareness of scarcity and value of land and encourage them make the investments necessary to improve the land. The government envisaged: parcelling Trust Land into ranches with freehold titles held by groups of pastoralists, registration of permanent members of each ranch, exclusive of members from other group ranches, allocation of grazing quotas (that is, the number of livestock per group ranch) and development of shared ranch infrastructure through loans to the group (for example, water points, boreholes, dips and vaccinations). Group ranch members would care for their own livestock but collectively use and manage the ranch, including maintaining ranch boundaries and preventing non-members from accessing and using their land. Members would pay user fees and be collectively responsible for loan repayment (World Resources Institute, 2011).

The four steps used to establish a group ranch were first, the boundaries between Maasai sections of traditional grazing units were established by the pastoralists with the assistance from the government, and formerly approved by Registrar of Group Lands in Nairobi; second, these 'adjudication sections' were then divided into group ranches; third, household heads were asked to register for one group ranch; and fourth, the formulation of a group ranch committee to manage ranch affairs (World Resources Institute, 2011). The group ranch concept was implemented principally through the Kenya Livestock Development Policy (KLDP). In phase one (1968-74), the boundaries between the adjudication sections for group ranches throughout Maasai land were determined and in phase two (1975-78) and phase three

(1979-82) the divisions of these areas into group ranches, their incorporation and establishment of additional group ranches in other areas was done. The Maasai embraced the group ranches because they offered finances to develop ranch infrastructure and expansion of herds, certainty of maintaining their land holdings, socio-cultural and political stability and greater control over traditional Maasai land. Some of the impacts on the group ranches of the changes in land use and management patterns include: pressure on ranch boundaries increase and land access competition, fencing of grazing lands, privatization of traditional drought dispersal areas, more individualistic attitudes replacing traditional resource sharing and access, restricted mobility, dry season grazing areas are inaccessible, heavy losses of livestock and crop failure in case of changes in weather patterns, limited options to adopt in case of droughts and increased vulnerability among the group ranchers (Flintan & Puyo, 2012).

Management Model Applied in Laikipia group Grazing Lands

To manage and govern the Laikipia grazing lands, stakeholders have embraced Holistic Management Framework (HMF) or approach shown on figure 6.6. This is a management process that allows people to simultaneously consider and balance social, economic and environmental concerns. Holistic Management helps stakeholders make better informed decisions that balance social, and environmental as well as financial considerations while leading in the direction they want their lives to take. The HMF is based on two principles and six practices that when put into practice are highly effective (Holistic Management Institute, 2012). The principles are first, nature functions in whole - individual parts do not exist in nature, only wholes and these forms and shape each other. Second, understand the environment being managed - not all environments are the same nor do they react the same way to the same influences, that is, taking the same action in one type of environment will have dramatically different results in another type of environment. The practices are: (1)

Defining what is being managed by creating a management inventory of the management team (decision makers) and assets (land, livestock, buildings, clients, vendors and money). (2) Stating what is to be done by creating a holistic goal - decision makers describe the life they want to live based on what they value most deeply, describe what they must create or produce to live that life and describe what must exist to sustain such a life into the future. (3) Aiming for healthy soil by considering the health of the ecosystem processes - water cycle, mineral cycle, energy flow and biological community. (4) Putting into consideration all tools by understanding and using what is available to manage resources - money, labour, human creativity, animals and other living organisms, fire, rest and technology. (5) Testing decisions by using the seven testing questions as they apply to the action(s) being considered - relating the action to the holistic goal, key concerns are honed-in and help ensure that decision or action taken is simultaneously socially, environmentally, and financially sound to move towards the holistic goal. (6) Monitoring for results by keeping on the right track with feedback loop, creating some monitoring criteria that will give the earliest indicator of the plan going off track, considering any unintended consequences that may arise from actions taken and recognizing the complexity of all systems.

According to NCT, the conservancy facilitates collaborative development of community conservation initiatives to enable group ranchers to collectively manage ecosystems to improve livelihoods, biodiversity conservation and range land management. Each of the nine-member group ranches has its designated area which is linked to all others. Together they have set aside a total of 43,000 acres (out of their 243,000 acres) for conservation purposes, which serves as a significant contiguous area for migration of wildlife. This is facilitated through a participatory planning exercise, often undertaken by a Non-Governmental Organization (NGO), such as, the AWF. Three categories are proposed according to the activities that are allowed therein: the core - preservation zone, the buffer zone - low intensity

multiple use zone for grazing and conservation and the high intensity use zone - for all other activities including settlements. In delineating their area group ranchers put into consideration seasonal waters and pasture use and distribution, wildlife distribution and densities, resource conflict hotspots, settlement patterns and areas of resource values or tourism or cultures. A management program is also produced involving three components zoning mapping, formalization of grazing management in the grazing areas and development of by-laws to ensure compliance. Group ranchers who break the grazing by-laws are fined. In case of prolonged drought, income derived from tourism and other income generating enterprises is used to lease grazing rights for the livestock for group ranch members within the neighbouring large-scale commercial private ranches. As members of the conservancy, group ranchers enjoy various benefits from the HMF model: (1) Participate and contribute in decision-making processes in the district regarding land use and security. (2) Live harmoniously with wildlife, benefit from them and help manage and protect their resources from neighbouring land users and cattle rustlers. (3) Are facilitated in the process of livestock migration. (4) Are given opportunities to expand eco-tourism projects. (5) Receive technical assistance in various income generating projects such as, negotiating and drawing contracts with partners. In terms of land use, member group ranches carry out planning and zoning of their land into different uses including conservation (mainly eco-tourism).

The group ranchers have embraced the HMF management model applied by NCT because as many of them attested they feel a sense of belonging when they are part of the decision making process, that their welfare is taken into account when they are given opportunities for eco-tourism income generating projects, their security is assured and enhanced in regard to livestock rustling by other pastoralist communities, greater harmony and coexistence with wildlife since there are corridors created for their movement through the group ranches and they receive technical assistance in regard to land use, water and environmental management.

Figure 6.6: Holistic Management Framework

Principles

1. Nature functions in whole environment		2. Understand your	
Practice 1	Inventory under whole management	Management team	Assets
Practice 2	Purpose	Mission Statement	
	Holistic Goal	Quality of life, values, behaviour, systems and vision	
Practice 3	Ecosystem processes	Biological community - Water cycle - Mineral cycle - Energy cycle	
Practice 4	Tools for managing Ecosystems	Human activity, technology, rest, fire, animals, living organisms and biological planning	
Practice 5	Planning and Monitoring Processes	Financial, land, grazing and biological planning	
	Testing Questions Categories	Root cause, weak link, comparing options, gross profit analysis, input analysis, vision analysis, gut check	
Practice 6	Feedback loop	Plan Control Monitor	Implement

Source: Holistic Management International

In NCT, the HMF involves dividing land into grazing blocks and then mapping these blocks including water points, local conditions and challenges. Assessing forage and number of days that livestock can be sustained on the forage. Combining herds to maximize the impact on fertilizer and hoof action on soil. Deciding the sequence of use of the grazing blocks while factoring in sufficient fallow time to allow regeneration; promoting the grazing of different sections within the block. Monitoring animal and soil impact. This process considers ecosystem processes of water cycle, energy flow, community dynamics and nutrient cycle; and uses fire, grazing, animal impact (hoof action), technology and fallow periods as range management tools. For water management, NCT relies on the Water Resources Users Association (WRUA), an organization started in 2010 to facilitate co-management of water

resources. To ensure sustainability of the WRUA, users pay a proportionate water: group ranches 5, 000 Kenya Shillings each, conservancies 10, 000 and farmers 3, 000 (Nassef, 2014).

Table 6.5: Factors affecting the management and governance of Laikipia group grazing lands

Cultural factors

Beekeeping is considered a poor man's activity and this prevents the group ranchers from taking up the activity as a source of income

Group ranchers consider their livestock as a personal and private property similar to children and not as a commercial asset that can be sold for an income; this leads to overstocking and consequently overgrazing

The group ranchers' community is highly patriarchal hence women and children do not have access or control of natural resources which limits their participation in decision making in regard to their use and management

Indigenous people are a tourist attraction and income earner for the county but some of their cultural/traditional activities negatively affect community's ability to embrace and practice new natural resources management techniques

Political factors

Group ranchers are plagued by centuries old rivalry among clan and tribe lines, this limits the level of collective decision making in the use and management of group grazing lands and fuels constant natural resource conflicts among them

Research and development activities through the Government of Kenya and partner institutions/organizations is improving natural resource use and management of the group grazing lands

Environmental factors

Unpredictable and changing weather patterns make planning on grazing lands difficult leading to death of livestock, natural resource conflicts among ranchers and human/wildlife/livestock conflicts over scarce resources

Increased conservation efforts on the Laikipia ecosystem with funding from the Global Fund

Social factors

Limited access to education

Low retention rates in schools

Economic factors

Increase in diverse sources of income such as beekeeping, timber harvesting, gum harvesting, tourism and poultry farming

Group ranchers, NCT and other stakeholders in Laikipia group grazing lands indicated that, in addition to the challenges that group rancher and NCT face in the use and management of the Laikipia group grazing lands, other factors, both internal and external play a role in its management and sustainability. These are indicated in Table 6.5 above from the highest in number to the lowest. The highest number of factors given by respondents are cultural. Reason being the fact that majority of the group ranchers belong to the Maasai ethnic group who to date have held on strongly unto their culture and traditions. Political and environmental factors then follow in terms of ethnic conflicts and general insecurity and the bio-physical conditions in the area. Lastly, are the social and economic factors indicated by the socio-economic infrastructure indicators and activities.

Measures are suggested to improve the management and governance of the Laikipia group grazing lands

Table 6.6 below shows the suggestions made by group ranchers, group ranch officials, NCT and other stakeholders to improve the group grazing lands from the highest to the lowest in number.

Table 6.6: Measures

State Support

GoK to consider ways of strengthening existing indigenous resource management and governance structures.

GoK to create policies of ownership and control by communities over wildlife and review policies on compensation of human and livestock loss from wildlife attacks.

GoK to review policies over shooting or killing of wildlife and allow for either regulated spot hunting or for community consumption.

The Government of Kenya (GoK) to ensure that all stakeholders endeavours are geared towards enhanced integrated conservation and developmental objectives.

The GoK to ensure and enhance security in Laikipia County in order to attract more local and international tourists in the area.

The GoK through the Ministry of Tourism to enhance marketing strategies for lodges and tourist attractions available in Laikipia County in order boost the income generating activities for the community.

The GoK through the Ministry of Agriculture, Livestock and Fisheries to create awareness among community members to change their negative perceptions of non-livestock income generating activities.

GoK through the WRMA to increase water sources or points to mitigate human-wildlife-livestock conflicts.

GoK to ensure sustained wildlife conservation, boost tourism, employment of rangers and motivation of school leavers to train in tourism courses to increase incomes.

GoK to consider allowing livestock into neighbouring Game Reserves during periods of prolonged dry seasons or drought.

Administrative

The NCT through the Ministry of Lands to advocate for secure rights to land on behalf of the group ranchers and harmonize mandates.

The NCT to enhance benefits from the group ranches and ensure that they are equitably distributed to all community members and the most efficient, effective and transparent expenditure of funds.

The NCT to employ a manager mandated to hold reporting, liaison and consultation meetings with various stakeholders in order to coordinate their respective efforts in the group ranches.

Each stakeholder's mandate in the group ranches should be clearly specified and documented to avoid duplication of efforts and activities.

The NCT should ensure, cultivate and maintain good relations among the various stakeholders in the group ranches to maintain community social cohesion and avoid conflicts.

The Department of Livestock to work on improving livestock breeds in terms of fast growth rates, high life expectancy, high body mass/size and high milk production.

As indicated in Table 6.6 above, most measures suggested by respondents fall under the state support category, mainly to do with issues of insecurity, land laws, wildlife policy, conservation, natural resources management, eco-tourism and other non-livestock income generating projects. The administrative measures follow in terms of enhancing good animal husbandry, land tenure and rights, coordination and harmonization of conservation and development initiatives by various organizations working with group ranchers.

6.5 Conclusion

The evolution of the management model over time has ensured improvement and efficiency in the use of the group grazing lands and enabled group ranchers to overcome governance challenges by incorporating the expertise of other stakeholders such as the community elders and financiers. The concept of group ranches has enabled the government in consultation with these stakeholders to settle pastoralists and modernize livestock production by meeting a set of five objectives: increase pastoral land productivity through increased off-take, improve the income generating capacity of pastoralists, avert landlessness among pastoralists as a result of large pieces of land being allocated to individual ranchers, avoid environmental degradation due to overgrazing caused by overstocking on communal lands and establish a livestock production system that embraces modern livestock husbandry while preserving traditional ways of life without causing any social unrests. The NCT has ensured that biodiversity is preserved, improvement and support of community livelihoods and alleviation of poverty and sound environmental conservation. The application HMF model has yielded various benefits to the group ranchers community specifically and the Kenyan economy in general, regarding meeting sustainable development objectives. The involvement and participation of various stakeholders in developing, designing, implementing, monitoring, enforcing, sanctioning and arbitration of the governance rules; each bringing in their expertise ensures efficient use, management and sustainability of the group grazing lands.

Governance structures applied have enabled the group ranchers to coordinate their use of the group grazing lands and consequently, overcome appropriation and provision problems. The challenges that group ranchers face is not only limited to complexities of human behaviour in the use of shared natural resources but are further compounded by the characteristics of the resource and socio-cultural factors of the community. Various internal and external factors affect the management and sustainability of the group grazing lands, ranging from economic (financial and marketing), socio-cultural (community attributes), political (administration and governance) and environmental (size and quality of resource).

However, group ranchers, NCT and other stakeholders in Laikipia group grazing lands expressed the specific measures through which the HMF model and governance structures can be strengthened through state agencies and ministries to ensure security of tenure for group ranchers, distribution of benefits, coordination and harmonization of activities among stakeholders, awareness creation and improving livestock breeds; and government involvement and support in terms of integrated natural resources management and conservation, wildlife policy, security and human-wildlife-livestock conflicts.

CHAPTER SEVEN

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

1.1 Introduction

This study set to understand the evolution of management dynamics and operation of governance structures developed by resource users and other stakeholders in three large scale Common Property Resources (CPRs) in Kenya. Specifically, the study sought to examine the evolution of management dynamics, identify the management model applied and its functioning, identify the governance structures, the phases and challenges of implementing them and suggest measures to improve on the management and governance of the resource system. The study also sought to provide information on critical variables related to CPRs systems, user groups, institutional arrangements and the external environment. In addition, the study gives a comprehensive analysis of management models applied in the three CPRs. The general theoretical literature on CPRs have focused mainly on two basic but important conditions or categories. First, small scale communally owned and governed resources in terms of the physical or geographical size of the resource system with well-defined boundaries. Second, group or users size characterised by small numbers with similar identities and interests.

1.2 Summary of Findings

This section gives a synthesis of the findings to answer the study's research questions: (1) How has the management dynamics in the resource system evolved over time? (2) What management model is applied in the resource system? (3) Who are the stakeholders their role and interest of these in the resource system? (4) What governance structures are applied in the resource system? (5) How are these governance structures designed, developed, enforced, monitored, sanctioned and arbitrated? (6) What challenges do users and other stakeholders

face in the resource system? (7) What other factors (internal and external) affect the management and governance of the resource system use? (8) What measures can be suggested to improve the management and governance of the resource system? (9) How do the applied management model designs in the three CPRs compare to each other?

The dynamics in the management in the three CPRs have evolved over time by moving from resource users having the autonomy in the management, governance and control of the resource system. The main empirical findings are case study specific and are provided within the respective chapters. In the case of Lake Victoria Fishery, traditional systems of management were used to manage the fish landing beaches. Up until early 1990s, fisheries management was based on a top-down centralised or command and control method. Currently, management in the lake is guided by the Fisheries Management Program (FMP) produced by Lake Victoria Fisheries Organization (LVFO) in 2001. It is based on fisheries co-management, aimed at getting the fisheries communities and other actors or stakeholders involved in fisheries management through beach level institutions that is, Beach Management Units (BMUs), local (county) and central government.

Before Kenya's independence, management in Mwea Rice Irrigation Scheme was undertaken by the British colonial government's African Land Development Authority (ALDEVA). The scheme was established in 1946, initially as a settlement for Mau Mau Rebellion detainees and later for residents of Kirinyaga South District. After independence, the Ministry of Agriculture, under the state corporation National Irrigation Board (NIB), was given all powers to manage and run the scheme. Rice farmers felt excluded from the management of the scheme and consequently, rice farmer's associations emerged to represent their vested interests. This led to the NIB being restructured to change the mode of service delivery to rice farmers, with its mandates being water management, operation and maintenance of the

infrastructure in the scheme. Non-core roles were devolved to the rice farmers; rice farmers associations namely Mwea Irrigation Water Users Association (MIWUA), Mwea Rice Growers Multipurpose Cooperative Society Limited (MRGM) and National Cereals and Produce Board (NCPB); and other stakeholders. Currently, management of the MRIS is through Participatory Irrigation (PIM) among these actors.

In Laikipia Group Grazing Lands prior to colonial rule, the area was inhabited by the pastoralist Maasai community, who over centuries had crafted traditional institutions and cultural practices to manage the grazing lands. Early 20th Century treaties between the British colonial government and Maasai leaders resulted in the movement of the Maasai out of the area to make way for large scale commercial livestock and game ranches for White Settlers. After independence in 1963, these ranches were retained under the government of Kenya and British colonial agreements. Consequently, some of the White Settlers sold their land to the government of Kenya, which in turn settled people from the Kikuyu community from Central Province in them as land buying companies. Later, some of the land was divided into group ranches to resettle the Maasai pastoralists under the World Bank's Rangeland Development Program. The rest of the land was registered as government land or 'outspans'. The existing group grazing ranches are managed by the ranchers, government agencies and other stakeholders using the Holistic Management Framework (HMF).

The research also identified other stakeholders or actors with whom resource users collaborate with, in addition to the lead government agencies and ministries. These stakeholders have specific role and interest in the resource system, each group bringing in their expertise to add knowledge to inform decision making process and work together to design, develop, implement, enforce, monitor, arbitrate and sanction governance structures applied in the CPRs. In Lake Victoria fishery, they are Lake Victoria Fisheries Organization

(LVFO); Lake Victoria Basin Commission (LVBC); Department of Fisheries, County Authorities and District Technical Staff; Scientific Committee and Fisheries Research Institutes; Academic institutions, private sector and Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs) and other lead agencies; and Development Partners, International organizations, donors and collaborators. In Mwea Rice Irrigation Scheme, they are the National Irrigation Board (NIB), Mwea Irrigation Agricultural Development Centre (MIAD), Mwea Rice Millers Limited (MRM), Mwea Rice Growers Multipurpose Cooperative Society (MRGM) and Research Collaborators and Institutions. In Laikipia group grazing lands, they are Northern Rangelands Trust (NRT), African Wildlife Foundation (AWF), Laikipia Wildlife Forum (LWF), National Environmental Management Authority (NEMA), Kenya Wildlife Services (KWS), Department of Livestock, Department of Veterinary Production and Development, Water Resources Management Authority (WRMA), Centre for Training and Integrated Research for ASALs Development (CETRAD), Private large scale commercial ranchers, Mpala Livestock Research Institute (MLRI), Nasaroni financial services organisation, Religious organizations and donors and World Vision. Compared to PFM and PIM there is more consensus in the HMF model in terms of its application in Laikipia group grazing lands because the nine group ranches are managed and governed under the umbrella body of the Naibunga Conservancy Trust. This makes it easier to make management decisions with few actors to consult and implement, monitor and enforce governance rules developed.

The research has also shown that the resource users, state lead agencies and ministries and other stakeholders in the three CPRs face various challenges in their daily operations in the resource system. These are mainly appropriation, provision, assignment or technical problems because of the complexities of human behaviour in shared natural resources which are further compounded by the characteristics of the resource and socio-cultural factors of the

community. In addition, there are other internal and external factors affecting efficiency, management and sustainability of the three CPR systems. Broadly, these are economic (financial and marketing), socio-cultural (community attributes), political (administration and governance) and environmental (size and quality of resource).

However, these management models and governance structures can be strengthened and improved by adopting measures that include changes in administrative structures and procedures to empower resource users' associations; enhance environmental, health and safety amenities and services for growth and development of the community; and increase state support and involvement in terms of financial, infrastructure and legal framework for effective management and enforcement of governance structures in the resource system.

1.3 Implications

In as much as the three case study CPR systems are distinctively different, the researcher observed certain convergences in management models and governance structures applied in the resource system. Firstly, the management model applied in each CPR is the Co-management, where the state agencies and ministries collaborate with resource users their associations and other stakeholders to implement the management model and governance structures in the resource system.

Secondly, the governance structures are developed through a consultative, collaborative and harmonization process of resource users cultural or traditional governance structures or institutions and the relevant state legal frameworks as contained in the Laws of Kenya. This highlights the issue of polycentric approach which emphasises on multiple centres of decision making which are independent and overlapping (Anderssen & Outcome, 2008). Thus, resource users are not the sole decision makers in terms of management and governance as is the case in small scale CPRs literature. This also allows for enforcement and monitoring to be

effective in terms of excludability and subtractability, consequently leading to sustainability of the resource system. In the case of Lake Victoria fishery, these are the harmonized Beach Management Unit's guidelines and by-laws and the Fisheries Act, CAP 378. In Mwea Rice Irrigation Scheme, they are the by-laws contained in the Mwea Irrigation Water User's Association Constitution and the Irrigation Act, CAP 347. In Laikipia group grazing lands, these are the group grazing by-laws developed by the Grazing Committee in each group ranch and the Land Act, CAP 287. The technical nature of some of the expertise and finance required in certain aspects of the resource system also means that the resource users cannot 'go it alone', rather, they will require the state and other stakeholders support and involvement. For example, irrigation agriculture researchers, irrigation water engineers, socio-economic infrastructure investment, livestock production and veterinary services, wildlife management services, administrative police, inter-state conflict resolution, among others.

Thirdly, the involvement of various stakeholders in the management and governance decision making processes has benefited the resource users in other areas of life such as the Non-Governmental Organizations dealing with issues of Child Labour, HIV/AIDs, conflict resolution, socio-cultural cohesion, education, environmental conservation, health and sanitation, among others.

Theoretical Implications

The findings of this study provide insights on how management dynamics have evolved over time that is, from pre-colonial, to colonial and post-colonial eras and how these changes have impacted on the resource system specifically, and society in general. The governance structures developed by resource users and other stakeholders have enabled them overcome appropriation, provision and assignment problems in their daily operations consequently,

ensuring resource sustainability (Ostrom, 2000). The involvement of state agencies and other stakeholders in the management and governance of the CPRs has ensured effective monitoring, enforcement, arbitration and sanctioning of governance rules (Olson, 1971; Wade, (1987). The challenges experienced in by stakeholders in the resource system stem from complexities of human behaviour in the use of the CPRs, characteristics of the resource and the socio-cultural factors of the community (Ostrom et al, 1994).

The design of the Co-management model used in the three CPRs takes advantage of the both state and local (resource users) managers by each party taking up responsibilities in management decision making and governance processes. This ensures that quality and less costly information available is applied in form of local and scientific knowledge of the resource system. Enhances greater accountability, effective monitoring and enforcement. Involvement and participation by resource users and other stakeholders enhances legitimacy of the governance system and users' cooperation or compliance. Generally, Co-management model design causes many disruptions in the way different stakeholders or actors relate with each other and with the resource system, thereby creating cooperation, competition, control and resistance. The governance structures are effective even if the actors have shared and often competing roles and interests and each tend to protect the broader public's interest and their own independence. Under these circumstances therefore, there is a high degree of efficient division of labour between the state agency and resource owners indicated by, first, long term durability and sustainability of the resource system. Second, investments that enhance or maintain resource system productivity. Third, rules or regulations to govern resource use, extraction, harvesting or access rights and shares by resource users and fourth, resource users are responsible for implementing, monitoring and enforcing of governance rules with only necessary limited oversight by state agencies.

The degree of participation by various stakeholders in Co-management model and governance in the resource system varies depending on the nature of the CPR, ownership and control of the CPR by resource users and the technical infrastructural investments required for the operation of the system. In the case of a lake fishery and group grazing lands, it involves a vast terrain nature of the resource system in terms of physical or geographical size and undefined or unclear boundaries, limited ownership and control of the resource by resource users (fishers and group ranchers) and limited or simple technical infrastructural investment requirements (fishing gear, equipment or cold storage facilities and livestock pens, sheds, fences or water points). This limit other stakeholders' degree of participation and hence their roles and interests to focus on other issues arising in the CPR such as, environment and conservation, Research and Development (R&D) or socio-economic services and infrastructure. While in the case of an irrigation system, even if it is large in physical or geographical size, there are clearly defined resource boundaries in terms of the land under crop cultivation, the farmers or resource users own and control their land parcels and huge technical infrastructural and expertise investments are must be made for the system to operate efficiently and effectively. Thus, in irrigation systems the degree of participation by other stakeholders is high who are either state agencies or their partners in areas of irrigation agriculture research, infrastructure, water management, processing, marketing and sale of the crop produce.

The challenges that resource users and other stakeholders face in management and governance of CPRs are more pronounced and severe in a lake fishery and group grazing lands. This is because of the nature of the resource system which has open access regime characteristics that limit exclusion of users; socio-economic and political factors such as, level of development; and socio-cultural attributes of the community such as, strong cultural and traditional belief systems. Hence, operations are hampered by complexities of regulating

human behaviour to solve appropriation, provision, assignment and technological problems. Challenges in the irrigation system are limited to the degree of autonomy in management and governance of the resource system among farmers, their associations and state agencies. There are other factors both internal and external which are beyond the scope of the resource dependent community that affect the application of management models and governance structures in CPRs either in a positive or negative manner. The more severe and complex the factor is, the more its impact is negative. Positive impacts not only enhance management and governance of the CPR but also ensures its durability, productivity and sustainability.

Policy Implications

The study has made several contributions to current literature on CPRs in terms of first, the large scale of the case studies in terms of the physical size of the resource system and number of group users in contrast to most studies focusing on small communally owned and governed resources (Agrawal, 2001). Second, provides information on critical variables relating to resource systems, user groups, institutional arrangements and external environment as noted in Ostrom (2000). Third, the use of different CPR systems as case studies as indicated by the nature of the resource system; method of use, extraction or harvesting; historical, traditional and cultural relationships between the resource system and users; and degree of state involvement in the use, management and governance of the resource system as indicated by Gibson, Ostrom & McKean (2000). Fourth, the use of Institutional Analysis Development (IAD) to analyse problems of CPR management and governance as emphasised by Gribble & Welland (1997). Finally, it adds to existing knowledge on the issue of Sustainable Development-Environment nexus, specifically, by providing facts to multidisciplinary environment and natural resources scholars regarding the management and governance dynamics of large scale CPR systems.

1.4 Conclusion and Recommendations

Management and governance issues in CPRs have evolved over time both in terms of the scale and involvement of other stakeholders in decision making process in the resource system. Specifically, the collaborations among state agencies, other stakeholders and resource users through their associations has enabled implementation, monitoring and enforcement not only be effective but also legitimate consequently, leading to sustainable resource use. Since resource users are not the sole decision makers, enforcement and monitoring of governance rules and structures is effective. Thus, making it possible to exclude non-group members from appropriating from the resource and to regulate use by group members (subtractability), which leads to sustainable resource systems. The Co-management models used in the three CPR case studies are the Partnership Fisheries Management (PFM) in Lake Victoria fishery, Participatory Irrigation Management (PIM) in Mwea Rice Irrigation Scheme and Holistic Management Framework (HMF) in Laikipia group grazing lands. The management and governance structures can be strengthened and improved by enhancing certain administrative, health, safety, environmental issues and increased state support and involvement in the resource system. The Co-management model design which is applied in the three CPRs yield various benefits to the resource-dependent community, public, state and resource system because it incorporates state and local (resource users) managers in decision-making. However, the degree of participation of other stakeholders, challenges faced and other internal and external factors, depend on the nature of CPR, ownership and control of the CPR by resource users and the technical infrastructural investments required for the operation of the system. It is recommended that further research be undertaken in other types of large scale CPRs in Kenya specifically and Africa in general; and more on comparative studies on the same type of CPR to different CPR case studies. Some of the limitations of this study include different geographical locations and large physical size of the three CPRs which

made field work logistics hectic and time consuming, however, the differences the resource system and users improved on the diversity and strength of the results. There was limited informal interactions between the research and the communities to make deep and meaningful engagements and observations, nevertheless, the other sources of data provided sufficient, reliable and valid information needed to achieve the study objectives.

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APPENDICES

Appendix 1 (a):

INTERVIEW GUIDE FOR LEADERS OF BEACH MANAGEMENT UNITS (BMU) Lake Victoria Fishery

A. BACKGROUND INFORMATION

1. Name of BMU?
2. How long has the BMU been in operation?
3. What is the total number of registered members?
4. What are the requirements for membership to the BMU?
5. Briefly explain how the BMU is structured.

B. GOVERNANCE STRUCTURES

6. Which of the following governance structures do the fishers apply in their daily operations in the Lake Victoria fishery?
 - i. Position rules:
 - A fisher should be a member of a fishers' association
 - Appointment of officials of the fishers' association
 - Appointment of a tribunal to settle disputes among fishers
 - Other (specify)
 - ii. Boundary rules:
 - A fisher is required to be a resident within the area
 - A fisher must use a technology or fishing gear
 - A fisher must pay for a fishing license
 - A fisher must own limited property related to fishing (berths)
 - Use of lottery (lots) to allocate random fishing spots to fishers
 - Allocate fishing spots based on a fisher's clan or ethnicity
 - A fisher to register to participate in lottery
 - A fisher to have continuing usage rights to Lake Victoria fishery
 - A fisher must belong to a local clan or ethnicity
 - A fisher must own or lease land in the area
 - Other (specify)
 - iii. Choice or authority rules:
 - Specifies to or from whom a fisher can lease fishing rights
 - Specifies who can lease land in the area
 - A fisher can ask someone else to perform maintenance tasks in Lake Victoria fishery on their behalf
 - Specific actions to be taken in case a fisher violates an agreed upon rule
 - Other (specify)
 - iv. Aggregation rules:
 - Agreement on technology or fishing gear to be used
 - Agreement on maintenance services a fisher must perform for management of Lake Victoria fishery
 - Defined requirements to participate in lottery to allocate fishing spots
 - Set procedure for changing fisher's association rules
 - Other (specify)
 - v. Information rules:
 - Set quantity of fish a fisher can harvest per period
 - A fisher is required to report any illegal fishing observed to higher authority
 - A fisher to report maintenance services they perform towards the management of Lake Victoria fishery
 - Set procedures of passing all important information to fishers
 - Other (specify)

- vi. Payoff rules:
 - Set fishing license fees
 - Fixed penalty fees for unreported fishing in Lake Victoria fishery
 - Set fee charges for ownership of excess property related to fishing
 - Other (specify)
 - vii. Scope rules:
 - A fisher should fish from a specific location
 - A fisher should harvest fish of a specific size
 - A fixed time that a fishing gear can remain on a choice fishing spot
 - Fixed-orders that require fishers to take turns in accessing particular spots
 - Fixed-orders that requires fishers to harvest fish only in specific seasons
 - Other (specify)
 - viii. Other rules:
7. How do the fishers and fishers' association?
- Develop and design these rules?
 - Implement these rules in Lake Victoria fishery?
 - Ensure that these rules are followed by all fishers?
 - Deal with a fisher who fails to follow these rules?
 - Solve disagreements that arise as these rules are implemented in Lake Victoria fishery?
8. What challenges do the fishers and fishers association face in Lake Victoria fishery?
- C. MANAGEMENT DYNAMICS
9. How does the association assist fishers in managing the Lake Victoria fishery?
10. Name other organizations or institutions that fishers collaborate or work with in managing the Lake Victoria fishery.
- Community Based Organizations (CBO)
 - Government organizations, Ministries, and Agencies
 - Educational and Research Institutions
 - Environment Conservation Organizations
 - Financial Institutions
 - Media & Telecommunication Organizations
 - Religious Organizations
 - Non-Governmental Organizations (NGOs)
 - United Nations (UN) Agencies
11. In what ways are they involved in managing the Lake Victoria fishery?
12. How has the involvement of these organizations or institutions in the management of the Lake Victoria fishery benefited the fishers?
13. What kinds of conflicts arise between the fishers and these organizations or institutions as they use and manage the Lake Victoria fishery?
14. Briefly explain how changes that have been introduced in Lake Victoria fishery over the years in terms of its use and management affected fishers.
- Process of developing and designing rules
 - Process of implementing these rules in Lake Victoria fishery
 - Ensuring that these rules are followed by all fishers
 - Procedures of dealing with a fisher who fails to follow these rules
 - Process of solving disagreements that arise as these rules are implemented in Lake Victoria fishery
15. Any other comment you can make regarding the Lake Victoria fishery in terms of resource use and management?

Thank you

Appendix 1 (b):

INTERVIEW GUIDE FOR LEADERS OF MWEA IRRIGATION WATER USERS ASSOCIATION (MIWUA) Mwea Rice Irrigation Scheme

A. BACKGROUND INFORMATION

1. Name of Association?
2. How long has the association been in operation?
3. What is the total number of registered members?
4. What are the requirements for membership to the association?
5. Briefly explain how the association is structured.

B. GOVERNANCE STRUCTURES

6. Which of the following governance structures do the rice farmers apply in their daily operations in the Mwea rice irrigation scheme?

i. Position rules:

- A rice farmer should be a member of a rice farmers' association
- Appointment of officials of the rice farmers' association
- A rice farmer provides infrastructural investment (money contributions) in the rice irrigation scheme
- Appointment of a water distributor in the rice irrigation scheme
- Appointment of guards among the rice farmers
- Appointment of a tribunal to settle disputes among rice farmers
- Other (specify)

ii. Boundary rules:

- A rice farmer is required to farm within a specified physical distance
- A rice farmer may own or lease land in the area
- A rice farmer may own or lease shares in the rice irrigation scheme
- A rice farmer to pay certain fees for water supply
- Specified procedure on how a rice farmer becomes a member of association
- Specified qualifications for a rice farmer to be an official of the rice farmers' association
- Other (specify)

iii. Choice or authority rules:

- Specifies who can lease land in the rice irrigation scheme
- A rice farmer may ask someone else to perform maintenance services in the rice irrigation scheme on their behalf
- A rice farmer can pay a monetary fine instead of providing maintenance services
- Specified actions to be taken by a water distributor or guard in case a rice farmer challenges their initial actions
- Specific actions to be taken in case a rice farmer violates an agreed upon rule
- Other (specify)

iv. Aggregation rules:

- Agreement on maintenance services contribution for a rice farmer according to number of their shares in the rice irrigation scheme
- Set levels of maintenance services contribution required of each rice farmer
- Determine the procedure of reimbursing a rice farmer's excess infrastructural investment fees contributions
- A set procedure for changing rice farmers' association rules
- Other (specify)

v. Information rules:

- Set number of rice farmers to use the irrigation scheme at a particular period of time
- A rice farmer to report any illegal water use observed to higher authority
- A rice farmer to report maintenance services they perform in the rice irrigation scheme
- Set procedures of passing all important information to rice farmers
- Other (specify)

vi. Payoff rules:

- Set interest rate for leasing of shares in the rice irrigation scheme
 - Fixed penalty fees for unreported farming in the rice irrigation scheme
 - Reimburse a rice farmer for unused shares in the rice irrigation scheme
 - Set price for using a unit volume of water in the rice irrigation scheme
 - Set fees for not performing maintenance services in the rice irrigation scheme
 - Determine what other crops a rice farmer can grow in the rice irrigation scheme
 - Determine what other crops a rice farmer may sell water received from the rice irrigation scheme
 - Determine how the guards are paid
 - Determine what other labour obligations may be required from a rice farmer to maintain the rice irrigation scheme
 - Other (specify)
- vii. Scope rules:
- Fixed-percentage where water is divided into fixed amounts and distributed to rice farmers using a physical device to regulate it
 - Fixed-time slots where each rice farmer is assigned a period during which he/she may withdraw water from the scheme
 - Fixed-orders where rice farmers take turns to receive water from the scheme
 - Determined minimum water required and maintained for navigation or for generation of power in the scheme
 - Other (specify)
- viii. Other rules:
7. How do the rice farmers and rice farmers' association?
- Develop and design these rules
 - Ensure that these rules are followed by all rice farmers
 - Implement these rules in the rice irrigation scheme
 - Deal with a rice farmer who fails to follow these rules
 - Solve disagreements that arise as these rules are implemented in the rice irrigation scheme
8. What challenges do the rice farmers and rice farmers association face and how do they deal with them?

C. MANAGEMENT DYNAMICS

9. How does the association assist rice farmers in managing the Mwea rice irrigation scheme?
10. Name other organizations or institutions that rice farmers collaborate or work with in managing the Mwea rice irrigation scheme.
- Community Based Organizations (CBO)
 - Government organizations, Ministries, and Agencies
 - Educational and Research Institutions
 - Environment Conservation Organizations
 - Financial Institutions
 - Media & Telecommunication Organizations
 - Religious Organizations
 - Non-Governmental Organizations (NGOs)
 - United Nations (UN) Agencies
11. In what ways are they involved in managing the Mwea rice irrigation scheme?
12. How has the involvement of these organizations or institutions in the management of the Mwea rice irrigation scheme benefited the rice farmers?
13. What kinds of conflicts arise between the rice farmers and these organizations or institutions in the use and management of the Mwea rice irrigation scheme?
14. Briefly explain how changes that have been introduced in Mwea rice irrigation scheme over the years in terms of its use and management affected rice farmers.
- Process of developing and designing rules
 - Process of implementing these rules in the rice irrigation scheme
 - Ensuring that these rules are followed by all rice farmers

- Procedures of dealing with a rice farmer who fails to follow these rules
 - Process of solving disagreements that arise as these rules are implemented in the rice irrigation scheme?
15. Any other comment you can make regarding the Mwea rice irrigation scheme in terms of resource use and management?

Thank you

Appendix 1(c):

INTERVIEW GUIDE FOR LEADERS OF GROUP RANCHERS ASSOCIATIONS Laikipia Group Grazing Ranches

A. BACKGROUND INFORMATION

1. Name of Association
2. How long has the association been in operation?
3. What is the total number of registered members?
4. What are the requirements for membership to the association?
5. Briefly explain how the association is structured.

B. GOVERNANCE STRUCTURES

6. Which of the following governance structures do the group ranchers apply in their daily operations in the Laikipia group ranches?
 - i. Position rules:
 - A group rancher should be a member of a group ranchers' association
 - Appointment of officials of the group ranchers' association
 - A group rancher can hold rights but does not graze in the Laikipia group ranches
 - A group rancher provides infrastructural investment (money contributions)
 - A group rancher performs maintenance tasks (weeding, fencing, building repairs, etc.)
 - Appointment of a tribunal to settle disputes among group ranchers
 - Other (specify)
 - ii. Boundary rules:
 - A group rancher is required to reside within the area
 - A group rancher must own land in the Laikipia group ranches
 - A group rancher must graze livestock only in the current season
 - Specified procedure on how a group rancher becomes a member of association
 - Specifies qualifications for a group rancher to be an official of the association
 - Other (specify)
 - iii. Choice or authority rules:
 - Specifies who can lease land in the Laikipia group ranches
 - A group rancher may ask someone else to perform maintenance tasks on their behalf
 - A group rancher may pay a monetary fine instead of providing maintenance services
 - A group rancher may pay a monetary fine instead of installing fence
 - Specified actions to be taken in case a group rancher violates an agreed upon rule
 - Other (specify)
 - iv. Aggregation rules:
 - Agreement on grazing of external livestock in the Laikipia group ranches
 - Agreement on movement of livestock within the Laikipia group ranches
 - Agreement on maintenance tasks contribution according to number of their shares in the Laikipia group ranches
 - Set levels of maintenance tasks required of each group rancher in the Laikipia group ranches
 - Determine the procedure of reimbursing a group rancher's excess infrastructural investment fees contributions
 - A set procedure for changing group ranchers' association rules
 - Other (specify)
 - v. Information rules:
 - Fixed number of livestock a group rancher can graze in the Laikipia group ranches for a period
 - A group rancher to report any illegal grazing observed to higher authority
 - A group rancher to report maintenance tasks they perform
 - A group rancher to report or record any fencing they undertake
 - Set procedures of passing all important information to group ranchers
 - Other (specify)
 - vi. Payoff rules:
 - Set interest rate for leasing of shares in the Laikipia group ranches

- Fixed penalty fees for unreported grazing in the Laikipia group ranches
 - Reimburse a group rancher for unused shares in the Laikipia group ranches
 - Set price for grazing a unit of livestock in the Laikipia group ranches
 - Set fees for not performing maintenance tasks
 - Set fees for fencing the Laikipia group ranches
 - Other (specify)
- vii. Scope rules:
- A group rancher must graze only the number of livestock in the Laikipia group ranches
 - All infrastructural investments made must be to improve the Laikipia group ranches
 - Other (specify)
- viii. Any other rules:
7. How do the group ranchers and group ranchers' association?
- Ensure that all group ranchers follow these rules?
 - Implement these rules in the Laikipia group ranches?
 - Deal with a group rancher who fails to follow these rules?
 - Solve disagreements that arise as these rules are implemented in the Laikipia group ranches?
8. What challenges does the group ranchers and group ranchers association face and how do they deal with them?

C. MANAGEMENT DYNAMICS

9. How does the association assist group ranchers in managing the Laikipia group ranches?
10. Name the other organizations or institutions that group ranchers collaborate or work with in managing the Laikipia group ranches.
- Community Based Organizations (CBO)
 - Government organizations, Ministries, and Agencies
 - Educational and Research Institutions
 - Environment Conservation Organizations
 - Financial Institutions
 - Media & Telecommunications Organizations
 - Religious Organizations
 - Non-Governmental Organizations (NGOs)
 - United Nations (UN) Agencies
11. In what ways are they involved in managing the Laikipia group ranches?
12. How has the involvement of these organizations or institutions in the management of the Laikipia group ranches benefited the group ranchers?
13. What kinds of conflicts arise between the group ranchers and these organizations or institutions as they use and manage the Laikipia group ranches?
14. Briefly explain how changes that have been introduced in Laikipia group ranches over the years in terms of its use and management affected group ranchers.
- Process of developing and designing rules
 - Ensuring that these rules are followed by all group ranchers?
 - Process of implementing these rules in the Laikipia group ranches?
 - Procedures of dealing with a group rancher who fails to follow these rules?
 - Process of solving disagreements that arise as these rules are implemented in the Laikipia group ranches?
15. Any other comment you can make regarding the Laikipia group ranches in terms of resource use and management?

Thank you

Appendix 2 (a):

INTERVIEW GUIDE FOR ORGANIZATIONS & INSTITUTIONS Lake Victoria Fishery

A. BACKGROUND INFORMATION

1. Name of organization/institution
2. Nature of organization/institution
 - Community Based Organizations (CBO)
 - Government organization, Ministries, and Agency
 - Educational and Research Institution
 - Environment Conservation organization
 - Financial Institution
 - Media & Telecommunication Organizations
 - Religious Organizations
 - Non-Governmental Organization (NGO)
 - United Nations Agency
3. Period of operation in the Lake Victoria fishery
4. What is the organization/institution's specific role and interest in the Lake Victoria fishery?

C. GOVERNANCE STRUCTURES

5. What governance structures (institutions, rule systems, norms) has this organization/institution facilitated the fishers design and develop under the following categories:
 - Position rules, which specify the set of positions available for fishers, (e.g. who is a member of a fishers' association).
 - Boundary rules, which define how fishers enter or leave these positions, (e.g. a fisher must pay for a fishing license to fish in the Lake Victoria fishery).
 - Choice or authority rules, which specify the set of actions fishers can undertake, (e.g. specifies to/or from a fisher can lease fishing rights in the Lake Victoria fishery).
 - Aggregation rules, which specify the levels of resource use, (e.g. agreement on technology or fishing gear to be used in the Lake Victoria fishery).
 - Information rules, which specify information available to fishers, (e.g. reporting of illegal fishing in the Lake Victoria fishery to higher authority).
 - Payoff rules, which specify how benefits and costs are required, permitted and forbidden, (e.g. set fishing license fees in the Lake Victoria fishery).
 - Scope rules, which specify the set of outcomes (e.g. a fisher must harvest fish of a specific size in the Lake Victoria fishery).
 - Other rules.
6. How does this organization/institution assist the fishers and fishers' associations?
 - Develop and design these rules?
 - Ensure that these rules are followed by all fishers?
 - Implement these rules in the Lake Victoria fishery?
 - Deal with a fisher who fails to follow these rules?
 - Solve disagreements that arise as these rules are implemented in the Lake Victoria fishery?
7. What challenges does this organization/institution face in the Lake Victoria fishery and how does it deal with them?

D. MANAGEMENT DYNAMICS

8. Briefly explain how changes that have been introduced in the Lake Victoria fishery over the years in terms of its use and management affected fishers.
 - Process of developing and designing rules?
 - Ensuring that these rules are followed by all fishers?
 - Process of implementing these rules in the Lake Victoria fishery?
 - Procedures of dealing with a fisher who fails to follow these rules?
 - Process of solving disagreements that arise as these rules are implemented in the Lake Victoria fishery?

9. How has the involvement of this organization/institution in the management of the Lake Victoria fishery benefited the fishers?
10. What kinds of conflicts arise between the fishers and this organization/institution as they use and manage the Lake Victoria fishery?
11. What support measures can you suggest improving the governance structures for better use and management of the Lake Victoria fishery?
12. What external and internal factors affect the Lake Victoria fishery in terms of quantity and quality of fishery resources and quality of the fishery itself?
 - Economic factors
 - Social factors
 - Political factors
 - Cultural factors
 - Environmental factors
13. Any other comment you can make regarding the Lake Victoria fishery resource use and management?

Thank You

Appendix 2 (b):

INTERVIEW GUIDE FOR ORGANIZATIONS & INSTITUTIONS Mwea Rice Irrigation Scheme

A. BACKGROUND INFORMATION

1. Name of organization/institution
2. Nature of organization/institution
 - Community Based Organizations (CBO)
 - Government organization, Ministries, and Agency
 - Educational and Research Institution
 - Environment Conservation organization
 - Financial Institution
 - Media & Telecommunication Organizations
 - Religious Organizations
 - Non-Governmental Organization (NGO)
 - United Nations Agency
3. Period of operation in the Mwea Rice Irrigation Scheme (MRIS)?
4. What is the organization/institution's specific role and interest in the MRIS?

B. GOVERNANCE STRUCTURES

5. What governance structures (institutions, rule systems, norms) has this organization/institution facilitated the rice farmers design and develop under the following categories.
 - Position rules, which specify the set of positions available for rice farmers, (e.g. who is a member of rice farmers' association).
 - Boundary rules, which define how rice farmers enter or leave these positions, (e.g. a rice farmer is required to farm within a specified physical distance in the MRIS).
 - Choice or authority rules, which specify the set of actions the rice farmers can undertake, (e.g. lease of rights to/or from holder of usage rights in the MRIS).
 - Aggregation rules, which specify the levels of resource use, (e.g. set the levels of maintenance services contribution required of each rice farmer in the MRIS).
 - Information rules, which specify information available to rice farmers, (e.g. reporting of illegal water use in the MRIS to higher authority).
 - Payoff rules, which specify how benefits and costs are required, permitted and forbidden, (e.g. set interest rate for leasing shares in the MRIS).
 - Scope rules, which specify the set of outcomes (e.g. fixed orders where rice farmers take turns to receive water from the MRIS).
 - Other rules.
6. How does this organization/institution assist the rice farmers and rice farmers' association?
 - Develop and design these rules?
 - Ensure that these rules are followed by all rice farmers?
 - Implement these rules in the MRIS?
 - Deal with a rice farmer who fails to follow these rules?
 - Solve disagreements that arise as these rules are implemented in the MRIS?
7. What challenges does this organization/institution face in the MRIS and how does it deal with them?

C. MANAGEMENT DYNAMICS

8. Briefly explain how changes that have been introduced in the MRIS over the years in terms of its use and management affected rice farmers.
 - Process of developing and designing rules?
 - Ensuring that these rules are followed by all rice farmers?
 - Process of implementing these rules in the MRIS?
 - Procedures of dealing with a rice farmer who fails to follow these rules?
 - Process of solving disagreements that arise as these rules are implemented in the MRIS?

9. How has the involvement of this organization/ institution in the management of the MRIS benefited the rice farmers?
10. What kinds of conflicts arise between the rice farmers and this organization/institution in the use and management of the Mwea rice irrigation scheme?
11. What support measures can you suggest for improving the governance structures for better use and management of the MRIS?
12. What external and internal factors affect the MRIS in terms of the quantity and quality of rice produce and quality of the irrigation system?
 - Economic factors
 - Social factors
 - Political factors
 - Cultural factors
 - Environmental factors
13. Any other comment you can make regarding the MRIS in terms of resource use and management?

Thank You

Appendix 2 (c):

INTERVIEW GUIDE FOR ORGANIZATIONS & INSTITUTIONS Laikipia Group Grazing Ranches

A. BACKGROUND INFORMATION

1. Name of organization/institution
2. Nature of organization/institution
 - Community Based Organizations (CBO)
 - Government organization, Ministries, and Agency
 - Educational and Research Institution
 - Environment Conservation organization
 - Financial Institution
 - Media & Telecommunication Organization
 - Religious Organization
 - Non-Governmental Organization (NGO)
 - United Nations Agency
3. Period of operation in the Laikipia group ranches
4. What is the organization/institution's specific role and interest in the Laikipia group ranches?

B. GOVERNANCE STRUCTURES

5. What governance structures (institutions, rule systems, norms) has this organization/institution facilitated the group ranchers design and develop under the following categories.
 - Position rules, which specify the set of positions available for group ranchers, (e.g. who is a member of group ranchers' association).
 - Boundary rules, which define how group ranchers enter or leave these positions, (e.g. a group rancher must own land in the Laikipia group ranches).
 - Choice or authority rules, which specify the set of actions the group ranchers can undertake, (e.g. lease of rights to/or from holder of usage rights in the Laikipia group ranches).
 - Aggregation rules, which specify the levels of resource use, (e.g. set the levels of maintenance services contribution required of each group rancher in the Laikipia group ranches).
 - Information rules, which specify information available to group ranchers, (e.g. set number of livestock a group rancher can graze in the ranch at a particular time).
 - Payoff rules, which specify how benefits and costs are required, permitted and forbidden, (e.g. set interest rate for leasing shares in the Laikipia group ranches).
 - Scope rules, which specify the set of outcomes (e.g. a group rancher must graze only a given number of livestock).
 - Other rules.
6. How does this organization/institution assist the group ranchers and group ranchers' associations?
 - Develop and design these rules?
 - Ensure that these rules are followed by all group ranchers?
 - Implement these rules in the Laikipia group ranches?
 - Deal with a group rancher who fails to follow these rules?
 - Solve disagreements that arise as these rules are implemented in the Laikipia group ranches?
7. What challenges does this organization/institution face in the Laikipia group ranches and how does it deal with them?

C. MANAGEMENT DYNAMICS

8. Briefly explain how changes that have been introduced in Laikipia group ranches over the years in terms of its use and management affected group ranchers.
 - Process of developing and designing rules?
 - Ensuring that these rules are followed by all group ranchers?
 - Process of implementing these rules in the Laikipia group ranches?
 - Procedures of dealing with a group rancher who fails to follow these rules?
 - Process of solving disagreements that arise as these rules are implemented in the Laikipia group ranches?

9. How has the involvement of this organization/institution in the management of the Laikipia group ranches benefited the group ranchers?
10. What kinds of conflicts arise between the group ranchers and this organization/institution as they use and manage the Laikipia group ranches?
11. What support measures can you suggest for improving these governance structures for better use and management of the Laikipia group grazing ranches?
12. What external and internal factors affect the Laikipia group grazing ranches in terms of quantity and quality of livestock products and of the grazing lands?
 - Economic factors
 - Social factors
 - Political factors
 - Cultural factors
 - Environmental factors
13. Any other comment you can make regarding the Laikipia group grazing ranches in terms of resource use and management?

Thank you

Appendix 3:

Ethics Clearance Certificate



Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

R14/49 Mugiira

CLEARANCE CERTIFICATE

PROTOCOL NUMBER H14/07/23

PROJECT TITLE

Governance structures and management dynamics in large scale common property resources: cases from Lake Victoria Fishery, Rice Irrigation system, and Group Grazing Lands in Kenya

INVESTIGATOR(S)

Ms RK Mugiira

SCHOOL/DEPARTMENT

Wits Business School

DATE CONSIDERED

18 July 2014

DECISION OF THE COMMITTEE

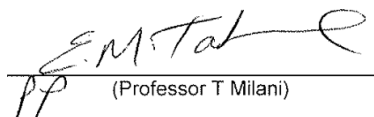
Approved Unconditionally

EXPIRY DATE

29/07/2016

DATE 30/07/2014

CHAIRPERSON


(Professor T Milani)

cc: Supervisor : Prof U Kollamparambil

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10000, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature

Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix 4:

Letter of Introduction to Participants

Date:

Good Day

My name is Rose Kathambi Mugiira, a Doctoral student in the School of Economic & Business Sciences at the University of the Witwatersrand, Johannesburg, South Africa. I am conducting an academic research study titled: **Governance Structures and Management Dynamics in Large Scale Common Property Resources: Cases from Lake Victoria Fishery, Rice Irrigation System, and Group Grazing Lands in Kenya**. The issue of governance of Common Property Resources (CPR) involves the designing, developing and implementing management structures that ensure resource users utilize it in a prudent manner to ensure its sustainability and durability.

As users and managers of these resources, you are invited to take part in this survey. The study seeks to investigate the evolution and operation of governance structures developed by users and other stakeholders in the three-large scale CPRs in Kenya in relation to management dynamics over time.

Your response is important and there are no right or wrong answers. This research study is both confidential and anonymous, which are guaranteed by not needing to enter your name on the questionnaire. Your participation is completely voluntary and involves no risk, penalty, or loss of benefits whether you participate. You may withdraw from the survey at any stage.

The first part of the interview guide captures the background information of the user's association; the second issues regarding governance structures; and the third resource management dynamics. Please provide the specific information and tick the appropriate box where applicable. The entire process should take between 10 to 15 minutes to complete.

Thank you for considering participating. Should you have any questions, or should you wish to obtain a copy of the results of the research study, please contact me on (254) 8891602-6 or rose.mugiira@students.wits.ac.za or mugiirar@gmail.com

My contact details: rose.mugiira@students.wits.ac.za or mugiirar@gmail.com

Cell number: (+27) 73 766 6110 or (+254) 72 152 3690

My supervisor: Prof. Uma Kollamparambil. Email: uma.kollamparambil@wits.ac.za

Kind regards,

Rose Kathambi Mugiira

Doctorate Student: School of Economic & Business Sciences

University of the Witwatersrand, Johannesburg, South Africa

Appendix 5:

Participants Formal (signed) Consent Form

Title of Research Project:

GOVERNANCE STRUCTURES AND MANAGEMENT DYNAMICS IN LARGE SCALE COMMON PROPERTY
RESOURCES

Cases from Lake Victoria Fishery, Rice Irrigation System, and Group Grazing Lands in Kenya.

Name of Principal Researcher:

Rose Kathambi Mugiira
School of Economic & Business Sciences
Faculty of Commerce, Law & Management
University of the Witwatersrand, Johannesburg, South Africa.
Tel: +254 721 523960
Email: Rose.Mugiira@students.wits.ac.za

Nature of the research:

This is an academic research for the award of a Doctoral Degree.

Participant's involvement:

As a stakeholder in the Lake Victoria fishery; or Mwea Rice Irrigation Scheme; or Laikipia Group Grazing Ranches. I acknowledge the following:

- I agree to participate in this research project.
- I have read this consent form and the information it contains and had the opportunity to ask questions about them.
- I agree to my responses being used for education and research on condition that my privacy is respected, subject to the following:
 1. I understand that my personal details will not / may be included in the research / will be used in aggregate form only, so that I will not be personally identifiable (delete as applicable.)
 2. I understand that I am under no obligation to take part in this project.
 3. I understand I have the right to withdraw from this project at any stage.

Signature of Participant:

Name of Participant:

Signature of person who sought consent:

Name of person who sought consent:

Date:/...../.....

Appendix 6:

Map of Kenya (Counties)



Source: Google Maps (2015)

Appendix 7:

Research Permit



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:

5th December, 2014

NACOSTI/P/14/5994/3815

Rose Kathambi Mugiira
University of Witwatersrand
SOUTH AFRICA.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *"Governance structures and management dynamics in large scale CPRS: Cases from Lake Victoria Fishery, Rice Irrigation System and Group Grazing Lands in Kenya,"* I am pleased to inform you that you have been authorized to undertake research in Homa Bay, Kirinyaga and Laikipia Counties for a period ending 15th January, 2015.

You are advised to report to the County Commissioners and the County Directors of Education, Homa Bay, Kirinyaga and Laikipia Counties before embarking on the research project.

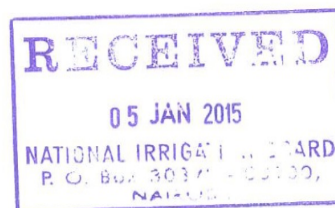
On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


SAID HUSSEIN
FOR: SECRETARY/CEO

Copy to:

The County Commissioner
Homa Bay County.

The County Director of Education
Homa Bay County.



National Commission for Science, Technology and Innovation is ISO 9001: 2008 Certified

THIS IS TO CERTIFY THAT:
MS. ROSE KATHAMBI MUGIIRA
of UNIVERSITY OF WITWATERSRAND,
JOHANNESBURG, 8411-100 NAIROBI, has
been permitted to conduct research in
Homabay , Kirinyaga , Laikipia
Counties

on the topic: GOVERNANCE
STRUCTURES AND MANAGEMENT
DYNAMICS IN LARGE SCALE CPRS:
CASES FROM LAKE VICTORIA
FISHERY, RICE IRRIGATION SYSTEM, AND
GROUP GRAZING LANDS IN KENYA.

for the period ending:
15th January, 2015


.....
Applicant's
Signature

Permit No : NACOSTI/P/14/5994/3815
Date Of Issue : 5th December, 2014
Fee Recieved : USD 21.67



.....

Secretary
National Commission for Science,
Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice. *M. K. M. K.*



REPUBLIC OF KENYA



National Commission for Science,
Technology and Innovation

RESEARCH CLEARANCE
PERMIT

Serial No. A 3842

CONDITIONS: see back page