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(CASELAP)

**ADDRESSING WATER RESOURCES DEGRADATION THROUGH IMPROVED
STAKEHOLDER PARTICIPATION IN THE UPPER ATHI RIVER BASIN**

By

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**A Thesis submitted in partial fulfillment of the requirements for the award of the degree of
Doctor of Philosophy in Environmental Policy.**

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DECLARATION

This thesis is my original work and has not been presented for the award of a degree in any other University.

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DEDICATION

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LIST OF ACRONYMNS

BOD	Biological Oxygen Demand
BAWRC	Basin Area Water Resources Committee
CAACs	Catchment Area Advisory Committees
COD	Chemical Oxygen Demand
DPSIR	Drivers, Pressures, State, Impacts and Responses
EMCA	Environment Management and Coordination Act
GDP	Gross Domestic Product
GOK	Government of Kenya
GWP	Global Water Partnership
IWRM	Integrated Water Resources Management
KNCPC	Kenya National Cleaner Production Centre
MPRVPS	Multipurpose River Valley Projects
NCWSC	Nairobi City Water and Sewerage Company
NEMA	National Environment Management Authority
RCMRD	Regional Centre for Mapping and Resource Development
SCMPs	Sub-catchment Management Plans
SDG	Sustainable Development Goal
UN	United Nations
UNEP	United Nations Environment Programme
WCED	World Conference on Environment and Development
WHO	World Health Organization
WRA	Water Resources Authority
WRMA	Water Resources Management Authority
WRUAs	Water Resource Users Associations

ABSTRACT

The rating of Kenya as a water scarce nation and the projection that the situation is expected to deteriorate further makes the need for sustainable water resources management critical. With the reality of scarcity, it is desirable that all stakeholders make choices and decisions that converge with requirements for sustainable development. Their individual and collective actions in use and management of water resources should reflect adherence to the principles of sustainable development. Whilst the Constitution of Kenya 2010; the “Water Act 2002”; “The Water Act 2016”; EMCA 2000; EMCA (Amendment) Act 2015 the “National policy on water resource management” (GOK, 1999); “The draft National Water Policy”, (GOK, 2012) and “the National Policy on Environment”, (GOK, 2014) uphold the need for sustainable management and anchor public participation, water resources continue to be degraded.

This study aimed to assess the drivers, pressures and impacts of water resource degradation in Upper Athi River Basin; the existing policies, laws and institutions that guide stakeholder participation in water resources management; and examine the factors that influence stakeholders’ participation in addressing water resource management. Stakeholders’ responses to policy interventions for abating degradation of water resources have also been analyzed with a view to identifying remedies for enhancing co-operation in the sustainable use and management of water resources in upper Athi River basin. The study was guided by the subsidiarity principle anchored under social theory and game theory.

This study combined both primary and secondary data. Primary data were obtained from interviews conducted on key informants and members of WRUAs and CAACs. The data was assigned values obtained from the operational definition of the variables. These included social

economic and participation variables. Secondary data on sustainable development concept; IWRM principles; drivers and responses to degradation; stakeholders' participation; water resource management policies; laws and institutional arrangements for stakeholders participation was obtained from research articles, books, legal publications, journals and reports on water resources management and environmental management.

DPSIR framework was employed to assess drivers of and responses to degradation in upper Athi River basin. WRUAs and CAACs (now BAWRCs) are identified as mechanisms for stakeholders' participation in water resources management in Upper Athi River basin. The factors influencing the participation of members of WRUAs and CAACs were examined through logit regression analysis of their responses in terms of relevance of information, representation, transparency, access to information and accountability. Stakeholders (Water users) responses to fines, licenses and incentives as policy interventions for ensuring collective action to address the problem of degradation are simulated using game theory based prisoners dilemma model. The results are presented in form of graphs and frequency tables; payoff functions with explanatory narratives.

The findings reveal that the main drivers of water resources degradation in upper Athi river basin comprise; increased industrial, commercial, residential and agricultural developments. The needs of these developments are the main sources of pressure on water resources in upper Athi river basin. The water resources in upper Athi river basin reflect a state of heavy degradation. This degradation inhibits the ability to supply water to drive economic activities, preserve biodiversity and sustain livelihoods. participation in water resources management is significantly influenced by inclusivity, information relevance, income and education levels of members of WRUAs; Kenya's responses for addressing water resource degradation are mainly of command and control nature,

while leaving out economic instruments; Technological measures and changing of social norms. Responses of water users indicate that fines, waste disposal licenses and incentives are effective tools for abating water resource degradation.

The study concludes that water resources in upper Athi River basin continue to be degraded despite there being legal and policy frameworks that anchor IWRM and sustainable management. WRUAs and CAACs (BAWRCs) offer important public participation platforms but need to be strengthened; Voluntary stakeholder participation is a key ingredient of sustainable water resources management, though it is not sufficient in resolving water resource degradation problems. Other responses that coerce or create incentives for stakeholder participation beyond command and control measures should be employed to achieve effective collective action. These responses include Fines, Licenses and incentives. They should be anchored in policy and law. Their application should be aligned to stakeholders' behavioral simulations that balance economic interests and environmental management concerns.

CHAPTER ONE

1.0 Introduction

This chapter provides background information to the study and a discussion of the Athi river basin, which is the focus of the study. This is followed by statement of the research problem; questions; purpose; objectives, and justification of the study. The aim of the chapter is to give the reader an overview of the river basin and give a rationale for the study.

1.1 Background Information

Kenya is classified as water scarce country with an estimated per capita fresh water allocation of 526 cubic meters per year (World Bank, 2011). According to WRMA, 2015 the country has five major drainage basins namely; Lake Victoria, Rift Valley, Athi, Tana and Ewaso Nyiro. The rivers within these basins originate from the five main towers identified as Mt. Kenya, Aberdares, Mau complex, Elgon and Cherengani. It is notable that these tower constitute the key forests in Kenya (Ibid). The drainage basins have a combined catchment area of 575,451 sq. Km and provide about 20.64 billion cubic meters of water per year (GoK, 2013). The projections of renewable surface (fresh) water resources indicate an increase of 20.6% from year 2010 to 2030 due to increased precipitation occasioned by climate change (ibid). On demand side, the country's population is "projected to increase from the estimated 38.6 million in 2010 to 51 million by 2030" (GOK,2013). This increment in population is bound to increase the quantity of water demanded in the country. Estimated projections indicate a 254% increment in fresh water quantity demanded compared to a 20.6% increment in the quantity of fresh water supplied within the same period. As a corollary, there is a projected increment in water deficit within the period under consideration. This supply-demand deficit will however, not be experienced uniformly

across the catchment areas since demand and supply will increase variably in the different basins. Athi River basin, for instance, has the highest water requirements for industrial and domestic use. This is attributed to the fact that Nairobi and Mombasa cities are located within this basin (Ibid). These towns and the surrounding areas have high population in residential areas. Many industries are also found within the two cities and their satellite centers. In future, therefore, water deficit in Athi river is expected to be about one-third (595 cubic meters per capita per year) of the total deficit in 2030.

The demand and supply challenges are compounded by serious catchment degradation resulting from a number of demographic, economic and technological drivers including; increasing population, urbanization, economic growth and poverty. These have exerted pressures on the basin such as increased agricultural practices, encroachment of riparian reserves, and deforestation (UN, 2006). Other drivers include pollution arising from human activities such as raw effluent discharge from non-functional urban sewer system, solid waste disposal, and discharge of untreated industrial effluents directly to water courses which poses serious water quality problems (WRMA, 2015). Water resources are also increasingly being degraded by inappropriate discharge of agricultural chemicals, municipal and industrial wastes (Kithiia, 2012). This degradation of water resources further reduces the capacity of the country to meet the water needs of the population thus compromising its ability of achieving sustainable development.

While drivers and pressures of water resources degradation are diverse, those cited above are mainly anthropogenic. Therefore, their resolution lies with reversing the negative actions of the

people involved. This has been echoed by policies including agenda 21 which in its principle 10 acknowledges that “environmental issues are best handled by participation of all concerned citizens at the relevant level” (UN, 1992). Indeed the Sustainable Development Goals (SDGs) adopted by member states of the United Nations anchors this position with respect to water resources management. Goal 6 (six), for instance, seeks to “ensure availability and sustainable management of water resources for all and encompasses the need for states to support and strengthen the participation of local communities in improving water and sanitation management” (UN, 2015). It further embraces and targets “the implementation of Integrated Water Resources Management (IWRM) at all levels” (Ibid). IWRM is itself anchored on participation of stakeholders in water resources management with the intention of giving people voice in decision making and implementation (Movik, 2014). The commitment of United Nations member states to the implementation of IWRM therefore affords water resources managers a policy direction that embraces the importance of stakeholders participation in addressing water resource management issues.

On its part, to address the water supply, demand and resource degradation issues, the Kenya government has been working on a number of policy reforms. The reform process was started in 1986 and resulted into the formulation of the National Water Master plan (NWMP) of 1992 (WRMA, 2012). This plan recommended “separation of water service provision from water resources management” (Ibid). This separation was aimed at ensuring that water sources and the catchment areas received equal attention to that given to the water services side. According to GOK, 1999, “the previous approach to water management had neglected water resources and left catchment areas unattended leading to increased degradation”. The National Water Master Plan

was followed by formulation and adoption of “Sessional paper No. 1 of 1999 on National Policy on water resources management and development” (GOK, 1999). The policy addressed “water resources management, water and sewerage development, institutional framework and financing the sector” (Ibid). The policy outlines the framework whose aim is promoting comprehensive water resources management and development with decentralized institutions. In addition it provided for participation of stakeholders in water management processes while adopting integrated water resources management (IWRM) as a means of bringing together all sectors and stakeholders to focus on sustainable water resources management (GOK, 1999). This adoption of IWRM and the recognition of the roles of stakeholders provided the foundation upon which the voice of people in decision making and collective action in water management could practically be achieved in Kenya.

The policy provisions were given legal force through the enactment of water Act in 2002. This Act had the objective of “providing for the management, conservation, use and control of water resources; the acquisition and regulation of rights to use water; regulation of water supply and sewerage services” (Ibid). It reflects the policy direction of giving attention to both the water services management and water resources management in an integrated manner. Part two of the Act sets the specific framework for water resources management. Sections 15 and 16 of the Act set the institutional framework for participation of stakeholders in water resources management as a means of implementing IWRM. Sections 15 and 16 made provisions allowing for establishment of Water Resource Users Association (WRUA) and Catchment Area Advisory Committees (CAAC) as fora for stakeholder participation in water resources management. This provided the statutory anchor for mainstreaming stakeholder participation in water resources

management within Kenya as committed to in the national water policy of 1999; and made participation of stakeholders in water resources management not just an aspiration but an obligation and a right safeguarded by law.

The Water Act of 2002 has hitherto remained the principal water resources management framework. It is however worth noting that the promulgation of the constitution of Kenya 2010 introduced new legal and operational dynamics that necessitated review of the Water Act of 2002. The Constitution introduced two levels of government, namely National and County; it reserved the ownership of water resources for the National government and only held by public trust. Water policy formulation was assigned as the National government role while the county governments were given the role of implementing specific National government policies on water conservation (GoK, 2010).

The constitution of Kenya, 2010 Art, 43 further gives “every person the right to clean and safe water in adequate quantities”. In addition the right to a clean and healthy environment has been granted by Art. 42 with the provision that this will be done “for the benefit of present and future generations” (Ibid). These provisions have the implication of elevating the right to water to a human right that is guaranteed by the supreme law of the land. Further, they give grounding to the concepts of equity between and among generations as proffered by the principles of sustainable development. Beyond these constitutional rights, Art. 10 cite participation of the people and sustainable development among values and principles of governance that must be respected. Further, Article 69 bestows obligations and duties to both the state and the

stakeholders to cooperate in “the conservation and protection of the environment and ensure sustainable development and use of natural resources” including water (Ibid).

To align the water resources management framework with the constitution of Kenya 2010, parliament has enacted the “Water Act 2016” (GoK, 2016). Under this Act, Several Provisions provide for stakeholders participation. Section 25 (1) establishes Basin Area Water Resources Committee which replace the CAAC’s that were established under the 2002 Water Act. These Basin Area Water Resources Committees are required to formulate “Basin area water resources management strategy” that “provides systems and guidelines that facilitate water users to participate in managing water resources.” (GoK, 2016). The act further provides for the establishment and functions of water resource uses associations under section 29 (Ibid).

It is important to observe that the “Environment Management and coordination Act of 2000,” which had provisions that related to participation of stakeholders and dealt with measures for addressing degradation has also been amended by the “Environmental Management and Coordination (Amendment) Act of 2015.” (GoK, 2015). Further, these constitutional values, rights, legal obligations and duties are complimented by effective policy, operational and technical strategies for implementation to achieve the desired water resource management outcomes. The strategies ought to be informed by contextual realities of the resource to be managed.

1.2 Water Resources Management in the Athi River Basin

The Athi River basin covers an approximated area of 68,900 sq. Km and is approximately 540 Km long. “The basins attitude ranges from 2600M to 1500M above the mean sea level in the upper zone, 1500M to 560M above mean sea level across the middle zone, and 560M to the sea level in the coastal zone” (WRMA, 2012). It consists of the southern part of Kenya east of the “Rift Valley and drains the southern slopes of the Aberdare ranges, and runs on the south eastern direction to the Indian Ocean. The climate across the basin is variable, with the upper zone being sub-humid; semi-arid and arid in the middle zone; and humid in the lower coastal zone” (ibid). It has an approximate population of 16.7 million which is the highest of the five basins in Kenya (WRMA, 2012). World Bank (2011) cites the Athi catchment as the only catchment in Kenya to have a water deficit in 2010. The deficit was estimated to be 334,942 cubic meters per day (Ibid, 2011). The economic impacts of this deficit are immense given that the Nairobi and Mombasa cities which get water from the basin contribute more than 50% of Kenya’s GDP. It is estimated that 57% of the water requirements in the Athi catchment are for urban uses (domestic industrial, commercial and institutional), though agricultural water requirements are also considerable (World Bank, 2011).

The highest water stress within the Athi basin is experienced within the Nairobi metropolitan area which is situated on the upper part of the basin. The water needs within Nairobi city alone are driven by domestic use (65%) with industrial and commercial uses accounting of the remainder (35%) (Ibid). The water stress is occurring in the context of a legal and policy environment that has made water an enforceable human right. This puts immense pressure on the state to invest more resources in procuring water for use by the citizens. It further increases the

vulnerability of the state to costs associated with legal actions by citizens seeking compliance with the constitutional obligations.

The water stress is further compounded by high levels of pollution especially in the sections where the river flows through urban areas, unplanned residential settlements, industrial areas and agricultural zones. A survey carried out by NEMA to establish compliance by industries in upper Athi basin with effluence disposal standards indicated that 71% of the industries sampled discharged effluent directly to the environment. Of these 65% did not comply with the set quality standards (NEMA, 2015). This in effect has resulted in degradation of water resources within this part of Athi river basin.

Pollution emanating from informal peri-urban settlements in Nairobi is evident across the three main tributaries of Athi River that flow through Nairobi city namely, Nairobi River, Mathare River and Ngong River (Mogaka, 2006). These tributaries are subjected to high levels of pollution emanating from numerous sources including domestic sewage, agricultural and industrial wastes. These wastes are discharged directly into the river system without any treatment, thus causing degradation of water resources and bringing forth risks to human health (Ibid). Kahara, 2002 observes that the water of Athi River and its tributaries in the upper part is unfit for human consumption and is considered an environmental and health hazard. The upper Athi Region is characterized by widespread degradation. Riparian land has been encroached upon and wetlands destroyed due to quest for land and ill application and enforcement of legal provisions (WRMA, 2012).

To address these enumerated challenges on water resources WRMA has embraced the participation of stakeholders through the structures of WRUAS in implementation of sub-catchment management plans (SCMPs) activities. These activities include catchment conservation, rehabilitation, and control of sedimentation (WRMA, 2015). It is however of concern that of the 121 WRUAs established in the Athi basin only 10 (8%) were reported as implementing SCMPs with sediment control activities (Ibid). This situation is further aggravated low establishment of WRUAs within the Athi basin. Less than 50% of the potential number had been established by year 2014 (WRMA, 2015). While the participation of stakeholders in water resources management is a key pillar in IWRM, this low level of engagement in implementation of key activities relevant to addressing water resources degradation compromises the ability to achieve the objectives of sustainable water resources management.

Given the foregoing it is apparent that the Athi river basin is experiencing serious challenges with regard to water resources management. It is clear that the problems are more pronounced on the upper part of the basin despite the regions strategic importance to social economic development of the country. The upper basin presents huge management challenges especially with the reality of the constitution of Kenya 2010 having made water and entitlement to a clean and healthy environment human rights. This study focused on this section of the basin since this is where most human activities including industries; commercial and retail enterprises; administrative activities and residential settlements are concentrated and where significant actions contributing to deterioration of water quality are being witnessed.

1.3 Statement of Research Problem

The rating of Kenya as a water scarce nation and the projection that the situation is expected to deteriorate further makes the need for sustainable water resources management critical. The present usage of water resources should not compromise the needs of the future generations and equity amongst present generations. With the reality of scarcity, it is desirable that all stakeholders make choices and decisions that converge with requirements for sustainable development. Their individual and collective actions in use and management of water resources should reflect adherence to the principles of sustainable development.

Whilst the Constitution of Kenya 2010; the Water Act 2002; the Water Act 2016; the National policy on water resource management (GOK, 1999); The draft National Water Policy(GOK,2012) and the draft National Policy on Environment (GOK, 2014) uphold the need for sustainable management and anchor public participation, water resources continue to be degraded. Further, despite the National Policy on Water Resources the water Act 2002, and Water Act 2016 adopting the concept and principles of Integrated Water Resources Management (IWRM), the anticipated results are not evident in the Athi River Basin. The basin exhibits high levels of degradation and pollution. There is discharge of municipal, industrial and agricultural waste into the river. Its riparian reserves continue to be encroached. Despite the provision for public participation in the water policy and the facilitating provision for formation of water resource users associations as institutions for cooperative management and constitutional requirements for public participation, the results of effective public participation in the management of water resources are not evident. Cooperation of all stakeholders in management activities geared at reversing degradation of the basin appears to be low, given the assertion by

WRMA (2015) that utility operators, industrialists and urban dwellers continue to cause degradation of water resources. It is necessary that this situation is reversed in order for sustainable management of water resources to be achieved

1.4 Research Questions

This study was guided by the following research questions.

1. What are the drivers, pressures and impacts of water resources degradation in Upper Athi River Basin?
2. How do existing policies, laws and institutional arrangements guide stakeholder participation in water resources management in Kenya?
3. What factors influence stakeholders' participation in water resources management in upper Athi River basin.
4. What are the stakeholders responses to policy interventions geared towards abating water resources degradation in the basin?

1.5 Purpose and Objectives

The purpose of this research was to assess stakeholder participation in implementation of IWRM with the aim of addressing water resources degradation and enhancing cooperation in the sustainable management of water resources in Upper Athi river basin. This is operationalized in the following specific objectives.

1. To assess the drivers, pressures and impacts of water resource degradation in upper Athi River basin.

2. To examine how existing policies, laws and institutional arrangements for stakeholder participation influence water resources management in Kenya.
3. To analyze factors influencing stakeholders participation in water resources management in Upper Athi River basin
4. To analyze stakeholders responses to policy interventions for abating water resources degradation in upper Athi River basin.

1.6 Justification of the study

This study is important given its focus on achieving effective stakeholders' participation and co-operation for sustainable water resource management. The availability of water resources in the desired quality and quantity is critical to economic and social development of the human populace. Increasing population and increased social economic activities within upper Athi River basin manifested in urbanization, industrial growth and agricultural activities have caused rapid increase in demand for water. This demand is not matched with commensurate supply of quality water. Sustainable management of water resources will result in achieving higher quality of water supplied to meet the pertaining demands.

Degradation of water resources results in impacts that adversely affect the health of the people, flora and fauna. Effective address of the water degradation challenges will help in eliminating the costs associated with poor health; loss of critical flora and fauna. The resources that would have been spent in addressing the health problems would be reallocated to other National Development Agenda.

This study will provide policy makers with insights on strategies for enhancing stakeholder participation in water resources management. This will give the stakeholders a stronger voice in decisions on water resource management. It further delves into water stakeholders behavioral simulations that would inform formulation of relevant policies, and operational strategies for water resource management to support sustainable development.

CHAPTER TWO

2.0 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

This chapter aims to discuss in details the major concepts and issues explored in this research to inform the questions being addressed by reviewing works of other scholars. It outlines the principles guiding the research and literature linking the concept of sustainable development to management of water resources. It discusses the concept of integrated water resource management and how participatory management forms the cog of this concept. The chapter espouses stakeholder participation approaches and principles as they relate to sustainable water resources management. Thereafter the factors that influence stakeholder participation in water resources management are discussed. The chapter further provides a methodological review to inform the means of addressing objectives of this study. The theoretical frame work providing the foundations for this study is discussed. It covers the subsidiarity principle under social theory and game theory. The conceptual framework is also outlined in this chapter

2.1 Sustainable Development and Water resource Management

According to Spies, (2003) “there is no general agreement about the precise meaning of sustainable development, but a general consensus exists on three basic concepts that are involved in sustainable measures. These concepts comprise living within certain limits of the earth’s capacity to maintain life; understanding the interconnections among economy, society and the environment; and maintaining a fair distribution of resources and opportunities for this generation and the next” (Ibid). This statement appears to align with the Brundtland Report titled

“Our common future” that made the key propositions on sustainable development. The WCED, (1987) observed that “humanity has the ability to make development sustainable to ensure it meets the needs of present without compromising the ability of future generations to meet their needs”.

A framework proposed by Herman Daly arranges the concept of sustainable development into a triangular set up of “3E’s; Environment, Equity and Economy” (Daly, 1990). This notion of the three E’s is also displayed in the work of Flint (2004) which explains that the three elements of Economic vitality, Ecological integrity and Social equity interact with each other to satisfy the requirements of sustainability. Accordingly Flint, (2004) explains “Economic vitality to be development that protects and/or enhances natural resource quantities through improvements in management practices / policies, technology, efficiency and changes in lifestyle”. Ecological integrity is taken to mean “the understanding natural system processes of landscapes and watersheds to guide design of sound economic development strategies that preserve these natural systems”. Social Equity on the other hand is taken to be “guaranteeing equal access to opportunities, natural resources and services for all people” (Ibid). Attaining the harmony of these elements is what is sought in the concept of sustainable development.

This study is premised on the view that the harmony sought in pursuit of sustainable development is to be attained progressively by pursuit of integrative management. Jabareen, (2008) holds that in order to achieve sustainability and ecological integrity, integrative and holistic management approaches are needed. From a policy perspective, “this concept of integrative management draws attention to the importance of maintaining a safe minimum

standard for all living and non-living assets necessary to maintain ecosystem functions and life support systems, along with at least representative forms of all other living natural assets” (Ibid). This is in line with the Rio declaration which states that “the protection of nature should form an integral part of the development process” (UN, 1992). It is this line of thought that is manifested in chapter 8 of Agenda 21 (UN, 1992), where it is proposed there be integrated systems of management to ensure that environmental, social and economic factors are considered together in a framework for sustainable development. This view helps to address gaps in the traditional development models where solution to society problems were taking “a piecemeal, singular approach, addressing issues of economics or environment or social health in isolation from one another” as observed by Flint and Danner, (2001).

Maintaining water resource quality and quantity needs therefore to be seen as key to ensuring economic health and bringing forth societal wellbeing. Besides supply of drinking water, fresh water ecosystems, provide many economically valuable commodities and services to society. Flint and Houser, (2001) enumerates these goods and services to include “flood control, transportation, recreation, habitat for plants and animals, production of fish and other goods”. These ecosystems benefits are costly and difficult to replace when aquatic systems are degraded. Besides being part of the ecosystem water is also a social and an economic good. “Demand for water resources of sufficient quantity and quality for human consumption, sanitation, agriculture and manufacturing is expected to intensify as populations grow, urbanization, industrialization and commercial development increases” (Ibid). It is therefore critical that water resources are managed in a sustainable manner.

To achieve sustainable development the United Nations member states adopted the 2030 agenda that is outlined in the Sustainable development Goals (SDGs) (UN, 2015). The agenda is significant since it commits States and all stakeholders to act in collaborative partnership to implement the plan of action in order to achieve the set goals. The SDGs outlines plans of action which among other issues covers the water resources management. Below is a review of the matters addressed in relation to water resources management.

2.2 Sustainable Development Goals and Water Resources Management

Water resources management issues are specifically addressed by SDG six (6). This goal commits states and stakeholders to “ensure availability and sustainable management of water and sanitation for all” (UN, 2015). To achieve this goal the agenda commits to implementation of “integrated water resources management (IWRM) at all levels by year 2030” (ibid). This commitment is important because it affords not just a policy direction but also a management approach with which actions will be directed. Besides implementation of IWRM, the goal targets “protection and restoration of water related ecosystems including mountains, forests, wetlands, rivers, aquifers and lakes by year 2020”. In addition a commitment is made to “improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated waste water; substantially increasing recycling and safe reuse globally” (ibid). These targets that are time bound provide useful basis upon which states and stakeholders can formulate programs for sustainable water resources management.

SDG 6.(b) further reiterates the undertaking of states to “support and strengthen the participation of local communities in improving water management” (UN, 2015). This undertaking is in line with the earlier commitment made under principle 10 of the Rio declaration to the effect that “environmental issues are best handled with the participation of concerned citizens “(UN, 1992). The goal places stakeholders at the center of water resources management. It indeed appreciates the role that people have in resolving development problems that they face within their local contexts. Given that IWRM is adopted as the approach to deliver sustainable water resources management, it follows that stakeholders’ participation in water resources management is also viewed within organizing frame of IWRM. The section below discusses this approach.

2.3. Integrated Water Resources Management (IWRM)

Mukhtarov, (2007) traces the roots of IWRM roots to “1930s with the commencement for multi-purpose River Valley Projects (MPRVPS), such as the Tennessee Valley Authority”. It is acknowledged that despite the main objective of those projects being “the use technology of to extract the maximum possible yield from watersheds, they attempted to integrate ‘water systems’ with other ecosystems” (Ibid). The other traces of elements of IWRM are from white (1961) Simon (1957) and Wolpet (1964) who focused on behavioral approach that exhibited two streams of thought. The first emphasized on the human perceptions of environment (water) while the second focused on the goals, aspirations and motivations of decision makers.

Hooper,2003 observes that while these works brought the human side to natural resource management spheres (including water) it was not until the 1970’s that the ecological and ecosystems approach to water resource management emerged from the actions of the environmental movement of 1970’s. This paradigm “recognized river basins as large complex

integrated ecological system. The watershed was seen as an integrated ecological system in which human impacts were just a component of the functioning of ecosystems” (Ibid). This approach set in motion the focus of development and application of IWRM as evidenced by the proceedings of the first UNESCO international Conference on water in 1977 (Medema, 2008) where the ecosystems approach was emphasized.

This approach became prominent in its effort to tackle negative consequences arising from land uses, reflected through the declining quality and quantity of fresh water (de Jong ., 1995). This focus was still limiting IWRM to addressing maximum possible human uses with minimum impacts.

This view was transformed following pressure from the global environmental management agenda focusing on sustainable development emerging from the World Conference on Environment and Development, Rio Declaration and Agenda 21. This influence is reflected in the conceptual development of IWRM as extended by global water partnership. GWP,(2000) which viewed “IWRM as the process that promotes coordinated development and management of water, land related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem” . However, Mehta and Movik, (2014) observe that “in practice IWRM emphasizes the concepts of holistic management and integration; decentralization; participation; economic and financial sustainability”. These concepts are quite broad and have attracted diverse interpretation in implementation (Ibid). Integration could for instance focus on diverse aspects of water management like quality and quantity; surface water; ground water; water supply and disposal (Ibid).

GWP- TAC, 2000 observes that the implementation of these concepts vary in different countries and regions. Despite this variety of implementation approaches, Medema (2008) cites the key elements of IWRM as being co-ordination across water and land resources; involvement of multiple stakeholders and integration. According to Van der Zaag,(2005), IWRM has over the years informed many policy makers despite having criticism from others as being too wide in scope. It has had sway over policy makers (Srinivasan, 2011). Conca, (2006) cites it as having influence in the advocacy for formulation of international water policy. Despite wide application, IWRM exhibits limitations and gaps. Mehta and Movik, (2014) notes that IWRM appears to idealize the achievement of win win scenarios in terms of equity, efficiency environmental sustainability. It underplays “tradeoffs and conflicts between these goals and the resulting conflicts between stakeholders” (Ibid). Saravan,(2009) observes that Integration, which is the focal organizing point for IWRM, assumes effective communication between different stakeholders seeking consensus instead of pursuing their private interests. This at times doesn't hold in practice and different water users and stakeholders pursue divergent goals and interests that frustrate cooperation. This undermines the intended outcomes of IWRM including sustainable management of water resources. IWRM is also premised on successful stakeholder participation. This is not always the case. Van Kopper, (2007) observes that challenges with respect to participation, elite capture and the influence of power relations across the social economic strata arise in practice.

Despite the progress registered in the implementation of IWRM in Kenya, there are challenges that have been encountered by WRMA: only modest compliance with regulation by water users

regarding abstraction and effluent discharges has been registered. Sometimes the regulations have been ignored all together resulting in conflicts in water sharing among users. (WRMA 2015). With failure to adhere to regulations by users, the problems of degradation of water resources are bound to escalate. This in turn compounds the problem of water quality and increases water scarcity. It is these limitations and gaps that arise in implementation that are the concern of this study. That is, the problems of participation and the non-cooperation which arise from pursuit of own strategic goals by stakeholders. IWRM is viewed in this study not as a fixed end in itself but as a process of experience building, policy learning and adoptive improvement applied by different actors in a specific place (Lubell and Edelenbos, 2013). The focus taken here is one of addressing the collective action problem among interdependent actors (stakeholders) within the upper Athi River basin. In addressing these issues, the goals of ensuring cooperation, adequate representation of stakeholders and adoption of decision making process that are fair as proposed by Lubell (2013) are adopted. Hence effective participation of stakeholders; social and economic behavior of the stakeholders (water users) that help in abating degradation of water resources are focal points.

2.4 Stakeholder participation in Water Resource Management

Literature presents several ways of defining a stakeholder. One approach identifies a stakeholder as an individual or group(s) who are affected directly (positively or negatively) by a decision or a consequence of a decision (Jansky. 2005). The second approach defines stakeholders as those that have ability (either directly or indirectly) to influence a decision or an outcome (Glicken, 2000; Mirghani and Savenije, 1995). Stakeholders are also identified in relation to a situation or

a specified issue such as water management (Pahl-Wostl, 2002). According to Rowe, (2004) “Stakeholder participation may be defined as a process where individuals, groups and organizations take an active role in making decisions that affect them”. Arnstein, (1969) defines participation as “the means for exercising citizen power to affect the outcome of a decision making process”. These decisions include policy making and implementation processes (Nana, 2013).

Stakeholder participation at times is used interchangeably with public participation but some authors distinguish the two. Jansky and Uitto,(2005) cites the international association for public participation as taking public participation to be “any process that involves the public in solving problems; making decisions and uses public input in making those decisions. Stakeholders’ participation on the other hand is seen as involving the people affected by a decision and those with the ability to influence its outcome” (Ibid). Another way of differentiating stakeholder participation from public participation has been the scale of participation. Public participation has been viewed as “citizen participation involving the public at large in issues of general concern” (Moellenkamp 2010) while stakeholder participation is involving specific stakeholder groups. The groups are addressed in their specific roles and relative to their stakes in a particular issue (Pahl–Wostl, 2002).

This study views stakeholder participation as contributing to and influencing decision making and implementation of water resources management process. Stakeholder participation takes place at either the decision making stage or the implementation stage (Desai, 2008). Both stages are viewed as important in water resources management and stakeholder participation is sought

for the two processes in this study. In addition, stakeholders are taken as individuals or groups that have interest in or are affected by or have the ability to impact directly or indirectly water resources management.

2.5.1 Typologies and Importance of stakeholder participation

Approaches to stakeholder participation are summarized by Reed,(2008) as; “ awareness, arising in the 1960s; incorporation of local perspectives in data collection and planning, from the 1970s; development of techniques that recognize local knowledge, in the 1980s; and, increasing use of participation as a norm in the sustainable development agenda, of the 1990s and subsequent periods”. Arnstein (1969) scoped the typologies of stakeholder participation in the form of a ‘participation ladder’. This categorizes participation in terms of the degree to which stakeholders are engaged. It displays participation as a continuum of increasing stakeholder engagement consisting eight rungs covering the following levels in an ascending order: “manipulation; therapy; informing; consultation; placation; partnership; delegated power and citizen control” (Ibid). This presents the various forms of participation in a hierarchy with the higher rungs being preferred than the lower ones. Richards (2004) however observes that different levels of engagement may suit different contexts depending on the objectives and ability of stakeholders to influence results.

As an alternative to the Arnstein’s participation ladder, a ‘wheel of participation’ has been proposed to emphasize the legitimacy of the different stages of engagement with stakeholders

(Davidson, 1998). Rowe and Frewer (2000) view participation according to the direction of information flow. They take gathering of information from participants as constituting consultation while disseminating information to participants as being communication. In this case participation is assessed as a dialogue defined by information flow. Other typologies address participation from a normative or a pragmatic sense. Reed,(2008) explains that “the normative participation focuses on process, carrying the view that people have a democratic right to participate in decision making” (including decisions on water resources management); While “the pragmatic arguments see participation as a means for delivering higher quality decisions”(Ibid).

This study takes the view that is proffered by Warner (1997) that none of these typologies fully covers the sustainability requirements that participatory processes should ideally meet. In designing participation processes therefore a consensus on the desired results is critical (Ibid). This consensus is deemed necessary to achieve sustainability (Lynam, 2007). The analysis of stakeholder participation in water resources management under this study is therefore in pursuit on context informed consensus that would procure sustainable management.

There are many benefits associated with stakeholder participation, and if these benefits are not realized then disadvantages associated with disillusionment may occur (Reed, 2008). Stakeholder participation reduces the probability of marginalization of members of society not at the center of decision making authorities (Ibid) and increases trust of citizens in decision (Richards, 2004). Stakeholder participation facilitates knowledge sharing and learning (Okali., 1994).This increases the chances of better quality decisions being made. Additionally through the interaction

of the stakeholders in the participation process, the potential for building new networks that increase social capital is created (Korff ., 2012).

Participation of local people facilitates better adaptation of technologies and interventions to local conditions (Reed, 2008). It helps build trust thus reducing the occurrence of conflicts (Stringer, 2006). Stakeholder participation offers opportunity to integrate diverse views and interests (Griffin, 1999). It optimizes implementation of projects and plans (Irvin, 2004).

Despite the numerous benefits some disadvantages of stakeholder participation have been enumerated. It is an expensive (Mostert, 2003) time consuming process (Luyet, 2005) with the potential to breed stakeholder frustration and fatigue (Reed, 2008). It might also lead to reinforcing of existing privileges and further marginalization of some groups (ibid) and also identification of new conflicts (Kothari, 2001). Stakeholder participation benefits override the disadvantages and it is the view of this study that better water resources management decisions would be arrived at with enhanced stakeholders' participation.

2.5.3 Goals of stakeholder participation

An attempt has been made to cite three key goals of stakeholder participation as being promotion of democracy; good governance and sustainable development (Nana, 2013). Though democracy has broad interpretations, this study views it as the form of self-governance for citizens. "They participate in choosing leaders; making and implementing policies and in the allocation of resources; and have high degree of civil, political and economic freedom" (Brinkerhoff, 2000).

Democracy emphasizes the equal rights of citizens to take part in shaping collective decisions in an environment of open deliberation (Smith, 2009). Democratic processes are expected to facilitate citizens at the local level to voice their needs and collectively obtain commensurate responses based on option and choices (DU Toit, 2011). Promotion of democracy is therefore key goal of participation that seeks to empower citizens and stakeholders with voice in shaping the decision that affect them (Kujinga, 2002).

The promotion of the voice members of the public including water users as provided for in the constitution of Kenya 2010 relates to this goal. It's Art. 1 provides a foundation for citizens to play an active role in governance based on the sovereign power that they hold both as individuals and a collective group. This sovereign power can be exercised directly or indirectly. Democracy and participation of the people are indeed anchored under Art. 10(2) (b) of the Constitution (GOK, 2010). Promotion of good governance as goal of stakeholder participation assumes the angle of making governments more accountable, more open and transparent (Nana, 2013). This study adopts the UNDP (2002) view of governance as “comprising the mechanisms, processes and institutions, through which citizens and groups articulate their interests, mediate their differences and exercise their rights and obligation”. Participation is considered a characteristic of good governance (Von Korff ., 2010). Public participation and sustainable developments are indeed provided for as national values and principles of governance (GOK, 2010) and are seen as the backbone of governance in Kenya (Kibugi, 2014).

At the global level participation is scoped by Principle (10) of the 1992 Rio Declaration which emphasizes that “environmental issues such as water resources management are best handled

with participation of all concerned citizens”. All nations are urged to facilitate public participation through enhancing transparency, accountability and setting systems of participatory decision making (UN, 1992). Stakeholder participation in decision making is therefore a necessity in achieving sustainable development (Richards, 2007). This study adopts the view that stakeholder participation is essential in ensuring sustainable management of water resources.

2.5.4 Key elements of stakeholder participation

The Rio Principle (10) breaks down the elements of public participation as consisting of: public opportunity to participate in decision making; access to information concerning the environment; obligation to facilitate and encourage public awareness; and, access to judicial and administrative proceedings including redress and remedy. These elements form key considerations in the formulation of policies, enactment of laws and setting of mechanisms that facilitate participation of stakeholders in the management of water resources. They provide the broader view in which stakeholder participation in implementation of IWRM is looked at in this study. Of particular concerns is the fulfillment of IWRM objectives through representation, consultations and provision of equitably opportunities in decision making at the relevant levels

The Rio Principle (10) has been complimented by the Dublin Principle Two (2) which provides that “water development and management should be based on a participatory approach involving users, planners and policy makers at all levels” (WMO, 1992). The elements cited above tie with the main principles of participation (Nana, 2013) outlined as; accountability; transparency; inclusiveness; legitimacy; social learning; conflict reduction; and, efficiency and equity. In analyzing stakeholder participation, assessment of these key elements and principles is important

in order to identify gaps or areas that require enhancement. Accountability for instance could be strengthened by election of local representatives; procedure for recall, third party monitoring or public reporting requirements (Bene, and Neiland, 2006). Enhancing transparency with respect to information quality and access is critical. Jansky,(2005) observes that, people with more information and ability to apply it have more advantages and power in decision making.

Involving the different stakeholders in decision making and implementation processes facilitates people's acceptance of those decisions while the representation of various groups cutting across the geographical, sectoral, cultural and ideological encompasses and enhances diversity. It also fosters ownership of decisions made bringing forth legitimacy (Nana, 2013). These elements of participation attest to its relevance and importance in bringing forth the sort of collective action desired by this study. Nana (2013) identifies two main approaches to stakeholder participation as transformative approach and the instrumental approach. "The transformative approach is explained as one that enhances the social, political and economic empowerment of individuals or the society" (Mohan, 2008). It adopts a people centered approach. It also enhances stakeholders' management capacity, increases confidence in their potential and raises collective consciousness (Ibid, 2013). The instrumental approach employs participation as a tool for attaining predetermined objectives or enhances policy outcomes (Hooper, 2005). People are mobilized and involved directly in activities of projects but participation ends once activities are completed (Oakey, 1991). This approach is criticized for only getting concerned with satisfying established demands for projects and not addressing long-term and sustainability concerns (Mohan 2008). It is however important to observe that this study views the transformative approach as superior in drawing accountability, inclusiveness and bring forth collective action.

2.5.5 Stakeholder participation and decentralization

Decentralization is described as the transfer of resources, public service responsibilities as well as the power of central government to make decisions to either lower levels of government, to dispersed state agencies, private sector, community organizations or resource user groups (Ahwoi, 2010). It is built on the assumption that government is made more responsive to local needs and preferences because local actors are better able to develop policies that suit local circumstances. (Graving., 2006). Decentralization improves the service delivery because decision makers are in closer contact with the citizens (Ahwoi, 2010) and also brings the government closer to the people (Cohen and Davidson, 2011). Associated with decentralization is devolution, which is seen as the highest form of decentralization since it involves full transfer by the central government of responsibilities, decision making powers, resources and control of government agencies to public authorities at lower level (Nana, 2013). Despite its perceived advantages, decentralization is sometimes viewed as shifting financial and administrative burden to local authorities, especially when it is done without requisite transfer of resources (Kemper, 2007). It has also been criticized for being expensive because many people are involved and a large amount of resources are required to bring people together (Bamba, 2006).

The criticisms notwithstanding, stakeholder participation is considered to be more effective in decentralized environment (Jaspers, 2003). It provides better opportunities for participation by local communities in decision making by opening up avenues for input and expanding their voice (Nana, 2013). Participation is seen as a context within which power sharing (decentralization) takes place between the center and local authorities in the decision making process (Oyugi,

2000). The complimentary relationship reflected between stakeholder participation and decentralization explains why the two are foundational elements of IWRM. A crucial aspect of IWRM is realigning of management structures and institutions management structures and institutions along hydrological boundaries (basins). This drawing of boundaries according to the characteristics of a water resource allows management strategies and actions to be more responsive to localized environmental variables (Stoa, 2014). IWRM implicitly endorses a decentralized decision making structure, where water resource management is undertaken at the level of water resource (Ibid). Both decentralization and stakeholder participation contribute to enhanced collective action necessary for sustainable water resources management which is a key concern for this study. Regardless of the approaches or the levels at which stakeholder participation takes place there are numerous factors that have either negative or positive influence to the results of the process. The section below reviews those factors.

2.5.6 Factors influencing stakeholder participation in water resources management

Factors influencing stakeholders' participation in water resources management may be categorised as; "economic, situational, developmental, and social cultural" (Neysmith and Dent, 2010). This general categorisation is best cast in looking at "incentives and barriers to participation" (Ibid). Neysmith and Dent (2010), indicates that the specific hindrances and catalysts for stakeholders' participation in water resources management reflect differently for local level actors (residents and community organisations), industries (including commercial entities) and government regulatory agencies. For local level actors (residents) basic monetary limitations, time constraints or prioritization of income generation and daily family needs may

become financial barriers to effective participation. For this group of stakeholders, situational barriers such as physical access to a meeting place; scheduling of meetings during odd hours; holding of meetings at locations far from their residence have the potential to discourage them from participating in water resource management for a (Ibid).

Developmental barriers to participation by local actors in water resources management at times arise from individual's lack of knowledge and skills; lack of power or decision making authority (Irwin and Stansbury, 2004). Social cultural norms, cultural differences among participants, communication imbalances, gender related in equity may discourage stakeholders' participation (Berkes, 2004). The lack of cooperation from authorities and peers at times becomes barriers to stakeholders' participation (Neysmith and Dent, 2010). Industries participation in water resources management projects is mainly limited by economic and situational barriers. If an industry views participation in water resource management activities as reducing a gain it derives from degradation or pollution, it will desist from taking part. If participation compels an industry or firm to change its production system that is economically gainful, the industry will avoid any involvement (Ibid). Equally if participation will require transparency on the part of industries in terms of independent assessments or disclosures, they may resist (Acutt, 2003). Griffin,(1999) identifies the main barriers to participation arising to government agencies participation in water resources management relate to time, direct costs and staff resources . Civil servants view it as less expensive for them to make decisions directly rather than engage in public consultations (Irvin and Stanbury, 2004).

The residual authority that government agencies possess in making decisions may be a disincentive to participation (Griffin, 1999). Elected officials and other bureaucrats may view participation as undermining their roles and authority (Involve, 2005). Besides the factors

outlined above as being barriers to stakeholder participation those that take the nature of incentives also have influence on the various categories of stakeholders differently. For local level residents and community groups, social interaction, gaining knowledge and skills, or ability to make a difference in the community can act as a motivation to take part in water resource management initiatives. Additionally where participation leads to avoidance of litigation or legal action and results in avoidance of legal costs, community members would get motivation to participate in water resources management activities (Neysmit and Dent, 2010). For industries, the threat to loss arising from fines, discharge fees or legal costs associated with legislative enforcement can act as a powerful incentive to participate in water related pollution reduction (degradation abatement) programmes (Triana and Ortalano,2005). Public pressure resulting from public release of adverse information by government agencies can be an effective tool against firms that do not comply with environmental regulations (Wang, 2004).

For government agencies, saving resources by minimizing enforcement and legal actions may give incentives to their taking part in stakeholder activities relating to sustainable water resources management (Jonsson, 2005). At times government agencies encourage stakeholder participation in water resources management to avoid or shift blame for failures (Griffin, 1999). Besides the incentives, power gradients between stakeholders; leadership; communication between and among stakeholders; capacity of stakeholders to make decisions and geographical access issues have been found to have significant influence in the manner that participation of stakeholders in water resources management takes place(Holes ., 2014). Factors related to the participation process itself such as organisation; communication; conflict resolution; transparency; equity and influence; stakeholder representativeness; integration of interests and definition of rules would significantly influence the quality o stakeholders participation in water resources management.

Additionally factors related to the outcome of participation such as accountability, emergent knowledge and social learning; and factors linked to political, social and ecological contexts influence stakeholders' participation (ibid). Muhammad (2014) also observes that demographic and socio-economic factors such as age, income, and education have an influence on how stakeholders participate in water resources management. Additionally constraints to effective participation may arise from poverty, language barriers, and negative cultural practices (Rossour, 2009). Given the appreciation of the factors that influence stakeholder participation generally, this study focused on how they are manifested in the context water resources management in Upper Athi River basin.

2.6 Empirical Review

Degradation of water resources has been cited by WRMA (2015) as a major problem in Athi River basin. To answer the objectives of this study, different methods for data analysis were identified and used. The DPSIR model was used to assess the water resources degradation drivers and pressures. In examining the existing policies, laws and institutional arrangements for stakeholder participation in water resources management, this study used document/content analysis from secondary data and key informant interviews. The logit regression analysis was used to analyze the factors influencing stakeholders' participation in water resources management. Finally, game theory was used in analysis of stakeholders' policy responses. The choice of these methods was not arbitrary but was informed by a review of similar studies where they were applied as discussed below.

2.6.1 Application of DPSIR framework in water resources degradation

The “DPSIR model is a functional analysis framework that depicts the cause-effect relationships in connection with environmental problems” (Smeets and Weterings, 1999). Sun, et al. (2016) traces the origins of DPSIR from “the Pressure-State-Response (PSR) framework”, put in place by the Organization of Economic Cooperation and Development in 1993(OECD, 1993). Kristensen,(2004) also confirms the origins of DPSIR to be OECD and affirms its applicability in assessing water management issues. This “PSR later on developed into the Driver, Pressure, State, Impact, and Response (DPSIR) model” (Kelble, 2013). Hou, (2014) associates its wide use to the “ability of capturing relationships between the sectors; social, economic, and environmental systems”.

Green and Randles,(2006) observe that it has been applied widely given its “ability to improve communication between policy makers and stakeholders”. Similarly Zhou, (2014) asserts that, “the DPSIR is a robust model for analysing changes in water resource systems”.

The DPSIR framework was applied in assessing water resources management at catchment level at Bakhtegan Iran. The study established that by limiting the agricultural development area the negative water balance of aquifers will be eliminated (Nezami, 2013). The model has also been applied in Ethiopia where integrated environmental management was determined using the model in Simen Mountain National Park which is a UNESCO-declared heritage site. The study revealed that the ecological management strategy was best suited to ensure biodiversity conservation and control human settlements (Essayas, 2010). Agyemang (2007) also applied

the framework in determining various indicators of environmental degradation in northern Ghana. The results of the study cite Government policies, population growth, poverty and land tenure system as the main causes for environmental degradation. Matome (2015) applied DPSIR to assess the water quality status of Mapungubwe national park in Limpopo province South Africa. The study identified Institutional weaknesses leading to poor implementation of water related laws and regulations as a key cause of reduced water quality. In Kenya, the DPSIR framework has been applied to conduct an ecosystem assessment of the Tana River basin. The assessment revealed that the upper catchment was the most degraded as a result of poor agricultural practices (Kamau and Wasonga, 2015). This study therefore adopts DPSIR to assess the drivers and pressures of degradation of water resources in Upper Athi River basin.

2.6.2 Application of Logit Regression Analysis in Stakeholder participation

Logit regression analysis has been used in numerous studies to model social economic and demographic factors influencing participation in natural resource management. A study carried out in Ethiopia to analyze factors influencing participation of local community in Natural resource conservation employed logit regression analysis. The study established that lack of support from the government and limited financial resources affected community participation in watershed management negatively (Besisa and Melesse, 2014). Bamimore (2015) also applied logit regression analysis in evaluation of factors influencing stakeholders' responses to payments for water supply service. The results of the study indicate that the number of adults in a household and the time they take in fetching water affects the stakeholders willingness to pay for water service provision. A Study on social economic factors influencing the roles of water

resource users in institutional reforms in China used the logit regression analysis. It established that there was little participation of farmers in water resources management due to limited incentives (Huang, 2009). Atsushi and Kana (2010) used logit regression analysis to investigate the link between “water resource users’ perceptions and collective action in water management”. The research found that for “water users to contribute to resource management”, satisfactory service provision is key (Ibid). Logit regression model was also used to analyze factors affecting attitude change of Bujnourd township wheat farmers towards participatory management of water resources. It was established that higher levels of education and knowledge in water resources management had a positive influence on changing the attitude of farmers towards participation (Seyed, 2014). Logit regression analysis is found to be a versatile tool for analysis because of “its ability to deal with dichotomous dependent variables. It is employed to find probability of occurrence of events in qualitative studies” (Baminose, 2015). The logit regression was therefore found applicable in the examination of factors influencing stakeholders public participation in implementation of IWRM in upper Athi River basin since it involved a set of qualitative data and the dependent variable was dichotomous taking any two values, 1(One) if the event occurs and 0 (Zero) if it does not occur.

2.6.3 Application of Content/Document Analysis in water resources management

Rwakakamba (2009) applied qualitative techniques such as key stakeholder interviews and review of documents to analyze policy measures geared towards water and environmental conservation in Uganda. The study revealed that despite Uganda having laws and policies geared towards environmental conservation, catchment areas continue to be encroached upon. Murtinho

(2010) also found qualitative approaches comprising of interviews with key informants applicable in the study of ways of community based water users have addressed water resources degradation resulting from climate variability in Andean region of South America. High levels of poverty associated with lower incomes and low education levels were found to negatively influence the ability of water users to adapt to climate variability. Detailed literature review, local observations and interviews with key informants was found useful by Kelly (2012) in studying ways of improving water conservation at golf courses in Bloomington, Illinois. The study found that wise water use could be improved through maintenance updates and changing golfers perceptions. Qualitative approaches comprising in-depth literature review and key informant interview were therefore found applicable to examining the existing policies, laws and institutional arrangements for stakeholder participation in water resources management in upper Athi river basin.

2.6.4 Application of game theory approaches in water resources management

“Game theory may be applied to predict how people behave following their own interests. It provides realistic simulation of stakeholders interests based behavior” and can therefore “provide planning, policy and design insights that would otherwise be unavailable” (Mandani, 2010). This assertion has been demonstrated by the application by Najafi (2013) of game theoretic approach in analyzing water sharing in Lake Urmia. The analysis revealed that the possibility of high losses in future does not prevent water users from free riding and pursuit of selfish interests that cause non-cooperation in water resource management. Game theory models have also been employed by Wei (2010) to analyse “water conflicts in the middle route of the south to North

water transfer project in China”. The results reveal that “water users are willing to cooperate if a mechanism can guarantee to transfer part of the benefits obtained from cooperation to cover their losses”. Dema (2014) has also applied game theory in informing research into better transboundary water rights treaty drafting. Basaran (2005) have applied game theory in determination of decision makers, strategies and conflicts in Niliifer Watershed. Game theory has extensively been applied to analyze “common pool resources management” (Ostrom, 1996). This study employs the “prisoner’s dilemma”(Ibid), which is a game theoretic approach to draw policy and management insights arising from simulations of stakeholders (water user) responses to policy interventions addressing the problem of water resources degradation. The approach is selected on the account of its ability to simulate behavior of different actors based on their interests.

2.7 Theoretical framework

The study was guided by the subsidiarity principle in social theory and game theory. Subsidiarity forms the foundation for this study since the water degradation problem is seen as emanating from actions at the local level. The principle provides insights to localization of problem solving including obligations to ensure individuals are equipped to fully participate in collective decision making and action. Game theory provides insights useful in resolving non-cooperation of individuals that hinders collective action in water resource management. Below is a detailed discussion of each of the theories.

2.7.1 Subsidiarity Principle

The subsidiarity principle has its origins in social theory and the doctrines of the Catholic Church; teachings of Aristotle and Thomas Aquinas. It is put forward as a way of emphasizing the importance of local institutions such as the family, households, villages, community and the church in development of social and political welfare (Stoa, 2014). The principle comprises the notion that the health of a society is in a great part a function of the vibrancy and empowerment of the individuals acting together through social groupings and associations. It consequently promotes problem solving at the local level (Vischer 2001).

Dommen (1993) summarizes the principle as generally making a case for “decisions to be made at the lowest possible level; by individuals or the family not the society at large; by the local community and not the state”. The role of the state reduced to facilitation by providing essential conditions under which individuals, families and other local associations operate. “Individual families and other local associations are seen as having a critical role in making good choices and actions, based on their own deliberations and judgments” (Finnis, 1998). Aroney (2014) finds the principle as considering “all groups to have a place and contribution to make as a means to human fulfillment. The state is required not absorb the individual or the family; they ought to be allowed free and unlimited action provided their actions are in line with common good and interest of others” (Ibid). This reasoning provides the basis for advancing stakeholder (public) participation in environmental management. It advocates for making of decisions at lowest levels. This is seen affording more chances for taking into account local environmental conditions and the views of the local people who carry the highest environmental costs (Dommen, 1993). Decisions here are seen as being taken with citizen participation (ibid).

It is this reasoning that has made the subsidiarity principle a foundational element of integrated water resource management (IWRM) paradigm, where water resources governance is primarily undertaken by institutions at the level of water resource. The management structures are aligned to hydrological boundaries thus allowing planning to be more responsive to localized environmental variables (Stoa, 2014). Indeed the “Dublin Statement on water and sustainable development has established stakeholder participation as pillar of IWRM” (WMO, 1992). The Agenda 21 chapter 18 and Rio principle 10 reflects the subsidiarity principle with respect to implementation of integrated water resource management. They seek decentralization of water resource management to local authorities, private enterprises and communities (UN, 1992).

From the foregoing, it apparent that there is a cardinal assumption that individuals, families, associations and communities at the local level will voluntarily make decisions and take actions that seek common good and that collective action will seamlessly occur. This is not always the case. Individuals may pursue their own separate interests that have negative consequences despite the state allowing participation at the local levels without impediments. Insights to the behavior of stakeholders (water users) be they individuals or organizations at the local level is important in designing strategies that would enhance positive collective action.

2.7.2 Game Theory

According to Nash, (1951), “game theory explores ways in which strategic interactions among economic agents produce outcomes with respect to the preferences (or utilities) of those agents, where the outcomes in question might have been intended by none of the agents. It is a mathematical tool for examining interactions between and among individuals, households, firms, or states, introducing methods for analyzing strategic choices among agents who share a

common resource “(Ibid). “Games are divided into two categories; cooperative and non-cooperative games” (Sumaila, 1999). In a “non-cooperative or competitive game, players are assumed to be motivated entirely by self-interest and the lines of communication between and among the players are faulty, or are non-existent” (Ibid). The focus of the theory is on every player’s strategy. This allows researchers to predict the possible solutions to games (Bailey, 2010).

The players are considered to be rational decision makers taking action. Strategies refer to alternatives that each player has to choose from; and information, either private or public, is the data upon which decisions are made. The players are governed by rules of the game which include laws, regulations, policies, treaties and natural processes. The decisions made results in scenarios that play out with the players viewing the outcomes in terms of payoffs (individual players valuation of gain or loss) (Dema, 2014) i.e. every player chooses what is best for his/her benefit and expects the best response (Basaran, 2005).

Game theory is applicable where there exist two or more agents having conflicting interests, with the outcome of their interactions depending on their (strategic) behavior. In this study there is eminent conflict between the users’ economic interests and the government’s interests to sustainably manage water resources. Dinar, (2007) finds water resource use as involving stakeholders (players) that are interrelated to each other. Conclusion is therefore made that great scope exists for analysis of strategic behavior among players in the ensuing water related conflicts (Ibid).

As population increases and availability of natural resources remains constant or decreases, the likelihood of conflict over management, extraction, and allocation of basic natural resources such as water increases. The ensuing escalation of negative environmental externalities affects

individuals, groups, and territories. Strategic behavior by individuals and groups therefore become critical if they are to survive (ibid). This need makes endeavors for sustainable management of natural resource including water important. The challenge is however the arising conflict from pursuit of what is rational to the individual (self-interest) against that which is sustainable (common interest). As Oslo, (1971) puts it, rational self-interested individual usually fails to act to achieve common or group interests.

Madani (2010) observes that “game theory can be applied in predicting how people behave, in pursuit of their interests. Usually decision makers (players) follow their interests while endeavoring to outdo one another by anticipating the other’s decisions” (Ibid). The theory thus offers a practical simulation of stakeholder’s interest driven behavior. Game theory based simulations of water users (stakeholders) behavior are important in identifying collective action based policy and management interventions for averting degradation. These intervention could be positive or negative incentives aimed at producing desired public goods (well managed water resources) (Wade, 1987).

2.8 Conceptual framework

The conceptual framework presented in Figure 2.1 shows the context within which challenges of sustainably managing Upper Athi River Basin water resources are manifested. The context is influenced by government plans which present a need to balance between economic development goals and environment (water) conservation goals. These plans are to be implemented within a background of growing population bringing forth high water demand; rapid urbanization

resulting in increased municipal wastes; industrial growth that brings increased industrial discharge; increased farming activities to support the growing populations.

While the current situation reflects water degradation, the environmental management goals reinforced by need to respect citizen's water rights that are guaranteed by the constitution and government policy have to be met. The commitment to the vision of achieving sustainable development requires interventions that bring forth collective action by all the stakeholders (water users) sharing the common resource (water). The interventions could be voluntary participation in water resource management or coerced cooperation through enforcement of mechanisms like fines, licenses and incentives. It is envisaged that the resultant collective action (cooperation) will ensure degradation of water resources is curtailed while stakeholders / users water needs are met.

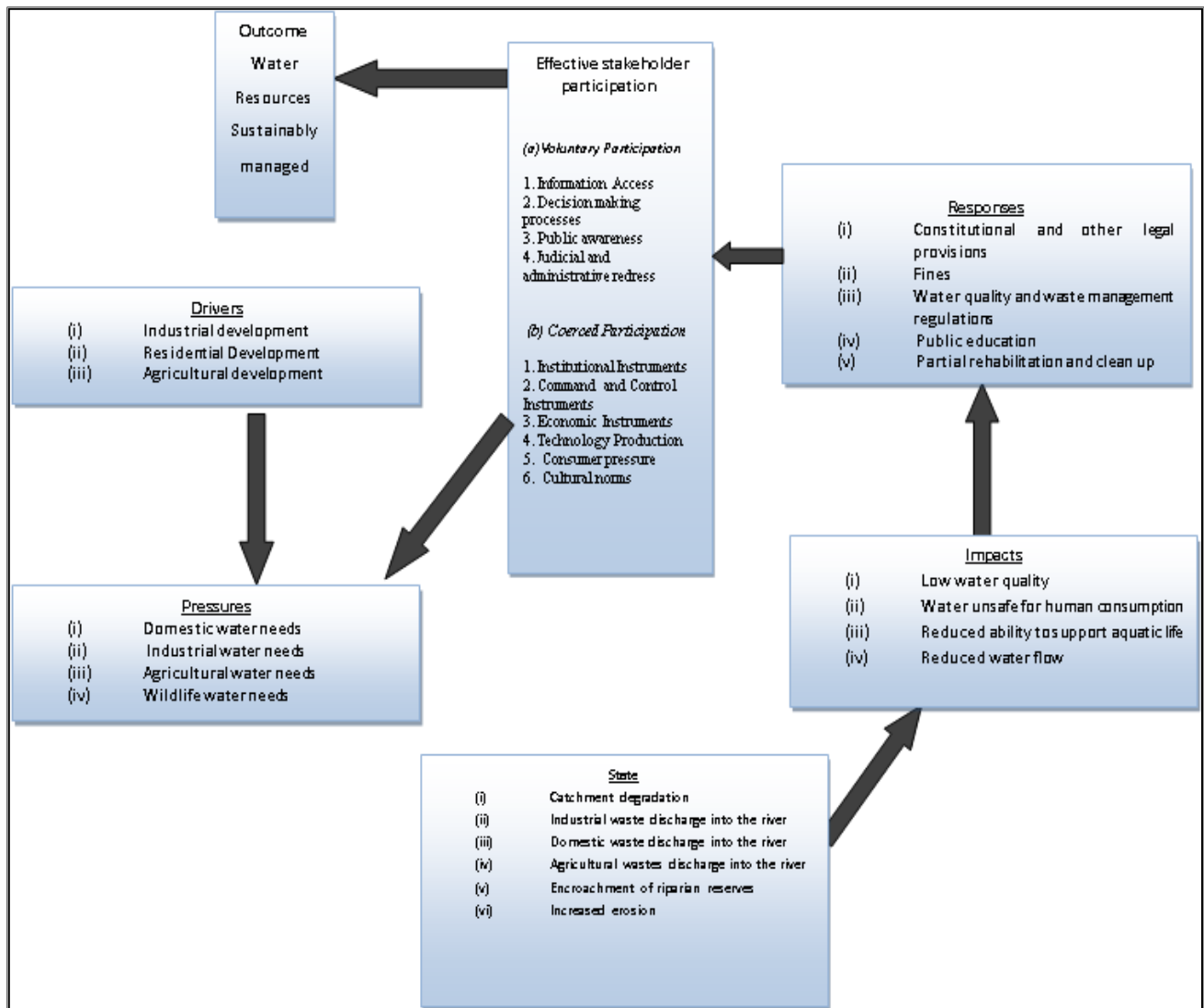


Figure 2. 1 Conceptual framework

Source: Author's Construction

2.8 Chapter summary and inferences

The discussion in this chapter establishes that there are linkages between sustainable development and water resources management. Maintaining water resource quality and quantity is seen as being key to ensuring economic health and bringing forth societal well-being. Sustainable Development Goal (SDG) number six commits states and stakeholders to ensure availability and sustainable management of water and sanitation for all. Integrated water resource management (IWRM) is viewed as an appropriate approach for ensuring sustainable management of water resources. It has numerous advantages given its focus on achieving goals of sustainable development. It nonetheless has limitations in its assumption that voluntary stakeholders' participation will always yield the desired collective action necessary in sustainable water resource management. It does not address challenges arising from failure of stakeholders to cooperate while they pursue their own interests. It is this gap that this study seeks to address. This study therefore views IWRM as a process of experience building, policy learning and adaptive improvement applied by different actors (Stakeholders) in a specified place. The focus is therefore to be placed on seeking collective action of these interdependent actors (users) in water resource management and development.

Stakeholder participation and decentralization are reviewed as key pillars of IWRM. Stakeholder participation is beneficial given its goals of promoting democracy, good governance and sustainable development. Giving voice to local actors (stakeholders) over decisions that affect them is found important in collectively deriving appropriate water policy formulation and implementation. Accountability, transparency, inclusiveness, legitimacy, social learning, conflict

resolution, effectiveness, efficiency and equity are the key principles (elements) of stakeholder participation. They ought to be embedded in mechanisms that seek to enhance stakeholders' participation in water resource management. Stakeholder participation is also more effective in a decentralized environment and therefore the focus of IWRM to decentralizing water management along hydrological boundaries (basin/catchment areas) is efficacious. It is therefore useful for this study to examine the stakeholder participation mechanisms available for water resource management in upper Athi River basin and Kenya in general to explore ways of having them enhanced.

Methodological review reveals that DPSIR framework is an effective approach used to explore the relationships between water resource systems and the socioeconomic system because it provides an organized method for analysing the causes, consequences and responses to changes in water systems. It is therefore applicable in analysing the drivers and impacts of water resources degradation and establishing their relationship with stakeholders' actions.

Logit regression analysis is also useful in studying the factors that influence participation of stakeholders in water resource management. Qualitative approaches comprising in depth literature review and key informant interview were identified as being relevant to examining measures that are useful for addressing water resources degradation as targeted by the study. Finally, Game theoretic approaches are useful in predicting how people behave following their interests. They are applicable in the simulation of stakeholder responses and provide management and policy insights sought in this study. The next chapter focuses on the methodology employed in this study.

The theoretical framework for this research is founded on the subsidiarity principle anchored under social theory and game theory. The subsidiarity principle origins are traced to the writings

of Aristotle, Thomas Aquinas and the social theory doctrines of the Catholic Church. It makes a case for decisions to be made at the lowest possible levels. This reasoning provides the basis for advancing stakeholder (public) participation in water resources management. The principle is thus a foundational element of IWRM.

The assumption that stakeholders at the local level will make decisions and take actions that seek common good and collective action will seamlessly occur does not always hold. Individuals at times pursue separate interests that have negative consequences despite the state allowing them to participate in governance without impediments.

Game theory is found to be useful in explaining the behavior of different stakeholders (water users) in relation to interventions that may be employed to motivate collective action that seeks common good. The theory is a mathematical tool that examines interactions between and among individuals, households, firms in making strategic choices with respect to a shared or common resource. Game theory is useful in any context where there are two or more agents facing conflict of interest; with final results of their interactions depending on their strategic behavior. Game theory based simulations of water users behavior are useful in identifying collective action based policy and management interventions for averting degradation. These interventions could be positive or negative incentives aimed at producing desired public good (Sustainably managed water resources).

The chapter also presents a conceptual framework that summarizes the problem context, sets the vision and provides the interventions that would result in the desired outcome. Water stress and degradation pertaining in Athi river basin despite there being reforms in constitution, legal and policy framework providing for sustainable management approached is to be addressed through

enhancing collective action both voluntary and coerced. The outcome would then be sustainable water resources management.

CHAPTER THREE

3.0 METHODOLOGY

This chapter articulates the specific methodologies adopted in answering the objectives stated earlier. It addresses sampling methods, data collection and analysis. The empirical framework which discusses the empirical methods used to answer the objectives of this research is also presented. The remaining sections describe how the results are presented.

3.1 Study site

The research was conducted within the upper Athi river Basin. “The upper portion of the Athi river basin is a high potential agricultural, residential, commercial and industrial area and hosts major urban centers” (WRMA,2009). It covers Nairobi, Kiambu and parts of Machakos and Kajiado counties. It experiences average rainfall of 700 mm per Annum. Its climate varies from sub-humid in the upper zones to semi arid in the lower zones (WRMA, 2012). This regions’ water quality deteriorates downstream due to degradation and pollution from municipal waste, domestic sewage, industrial effluents, settlements and agricultural activities consequently affecting water quality (Ibid) and hence its choice as a study site.

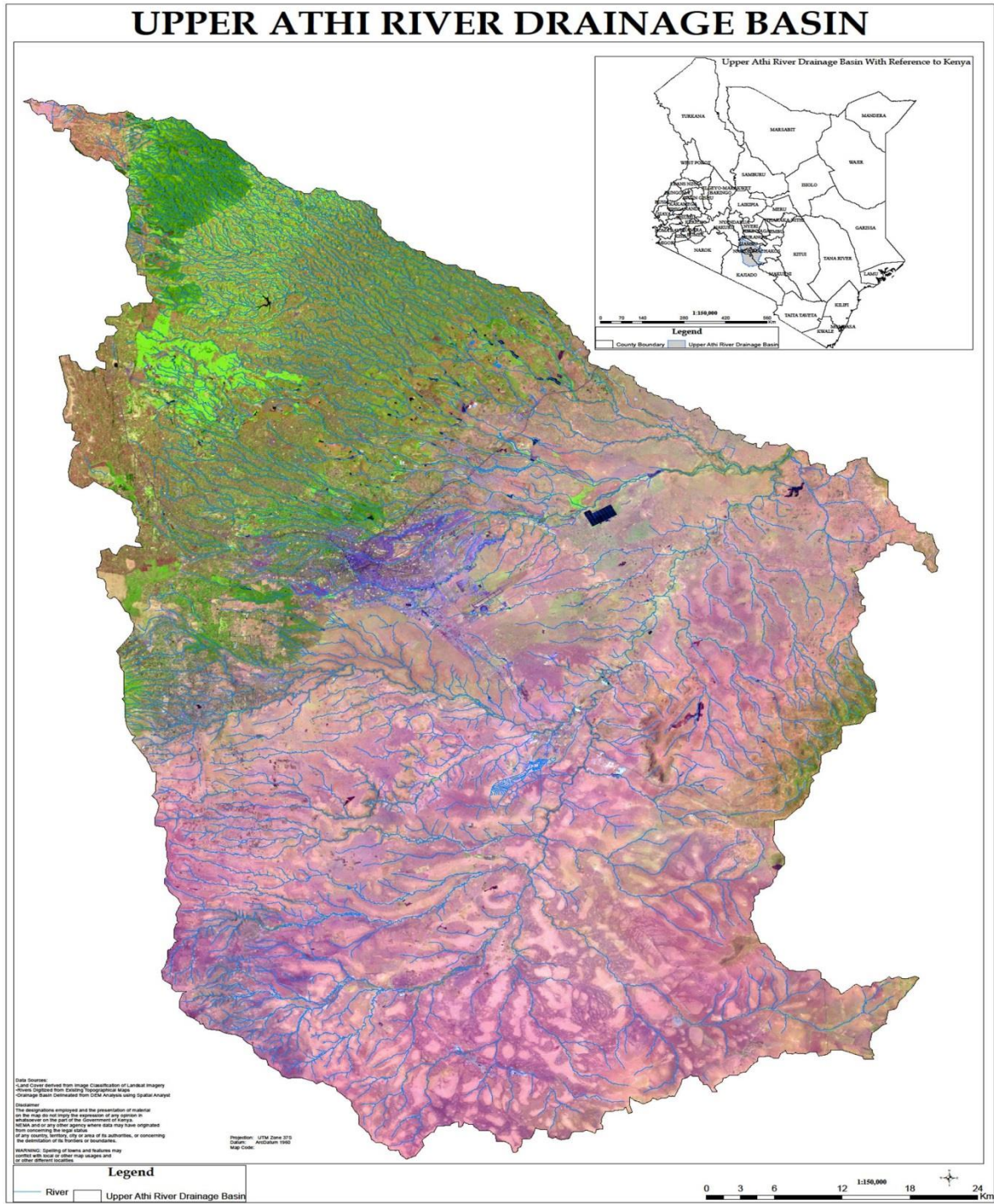


Figure 3. 2: Upper Athi River Basin

Source: Regional Centre for Mapping Resource and Development

3.2 Data needs, types and sources

This study combined both primary and secondary data. Primary data were obtained from interviews conducted on key informants and members of WRUAs and CAACs. The data was assigned values obtained from the operational definition of the variables. These included social economic and participation variables. Secondary data on sustainable development concept; IWRM principles; drivers and responses to degradation; stakeholders' participation; water resource management policies; laws and institutional arrangements for stakeholders participation was obtained from research articles, books, legal publications, journals and reports on water resources management and environmental management. They were presented in form of frequency distributions tables, regression models.

3.3 Sampling procedure and data collection

The sampling frame of this study was the legally established Water Resource User Association (WRUAs) and Catchment Area Advisory Committees (CAACs). Structured questionnaires were administered to the selected sample to collect the relevant data. The sample size was determined following Yamane (1967:886) a guideline which provides a simplified formula to calculate sample sizes with a known population size. The equation for sample size determination is given as;

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

Where n is the sample size, N is the population size and e is the level of precision. The total number of WRUAs within this region was 30. However the active ones were only 18. The 18

were therefore taken to provide the sampling frame. The total number of all the registered members in the 18 WRUAs was 2000. The sample size was calculated at 95% confidence level and level of precision of + or – 0.07%. This level of precision was chosen since it would not significantly affect the accuracy of the results and yet it would fit within the resource provisions available for the research. This yielded a sample size of 179.

The 18 WRUAs were given weights given using the number of members in each WRUA. Using these weights, quota sampling was employed to get a representative sample from each WRUA. On determination on the number of respondents to interview per WRUA, simple random sampling was used to get the final sample. A total of 190 respondents were finally interviewed to answer questions under objective three and four of the study. Key informants were purposefully identified to respond to policy questions. These included the regional water managers and two CAACs members.

3.4 Empirical Framework

Following theoretical and literature review in chapter two this section highlights empirical framework used in answering the questions posed on the basis of the literature and theories reviewed.

3.4.1 Assessment of Drivers, Pressures and Impact

The DPSIR framework was used to assess the drivers, pressures and impacts of water resource degradation. The drivers were identified by in-depth review of literature relating to physical degradation of the upper part of Athi River; Sediments load over time; presence of polluting

substances; observation of turbidity; results of chemical analysis confirming discharge of wastes into the river. The associated sources of the physical and chemical contaminants of the river were assessed in terms of human activities in this part of the basin. These were framed in terms of urban settlements such as residential, industrial and agricultural. The drivers and impacts of the degradation are discussed in a narrative form. The responses or interventions used to address the degradation problem ranging from institutional instruments, direct controls, water quality standards, market instruments; technological production, public education and changing of social norms are identified and examined through literature review and key informant interviews. The results are then presented and discussed in narrative form.

3.4.2 Examination of the existing policies, laws and institutional arrangements

These are identified through content/document analyses of literature including the constitution, statutes, regulations and rules. Key informant interviews are also used to obtain insights. The results are presented and discussed in a narrative form.

3.4.3 Analysis of factors influencing stakeholders participation

WRUAS were identified as the mechanisms for local level (primary) stakeholders' participation. Catchment area management plans were also identified as the key instruments for water resources management at the lowest levels. Key variables influencing stakeholders' participation were identified and the extent of their influence established using regression analysis using the logit model. The variables considered include demographic and social economic characteristics of WRUAs members such as level of education and income. In addition process variables comprising relevance of information; Representativeness; transparency; Access to information; Inclusivity, Accountability were considered. The relationship of the variables was viewed in

terms of the logit model From (Green, 2003) presented in the equation below which is used to assess the probability of participation in Athi-river basin;

$$Z_i = \beta_0 + \sum_{i=1}^8 \beta_i x_i + \mu_i \quad (2)$$

Where Z_i is the dependent variable or the probability of participation which occupies a value of 1 for participation, and 0 otherwise; β_i s are parameters to be estimated; and $x_1 - x_8$ represent marital status; income; representativeness; relevance of information; level of formal education (years); accountability; inclusivity; and access to information; μ_i is the disturbance term. There after stakeholders (users) responses on factors affecting each of the variables in actual process of participation were tabulated and deductions made.

3.4.4 Stakeholders Responses to Policy Interventions

Stakeholders' response to fines, licenses and incentives as policy interventions for ensuring collective action to achieve sustainable water resources management by abating degradation were tabulated. Game theoretic model of a prisoner's dilemma was applied to design games with the responses obtained. Games were played between Government and the various stakeholders (residential, farmers, industrialists) to simulate likely scenarios at different levels of fines, licenses or incentives. The results of the games by stakeholders versus government are presented in tables and graphs based on utility values derived from weights assigned to each choice

(payoff). From these functions deductions to inform policy and management interventions are made.

The game is based on a hypothetical situation where police are interrogating two prisoners for a crime for which they are both suspected to have committed. The prisoners are asked to confess and implicate the other and given rewards or punishment. The prisoners are kept in separate cells. The dilemma presented by this model is one of cooperation (Sellamna N, 2014). The most important implication for the prisoners' dilemma game is that it is rational for individuals not to cooperate with the other because defecting (betrayal) leads to the best outcome for them personally whatever the other decides. However if both prisoners act "irrationally" and cooperate both could gain.

Prisoners' dilemma game is used to analyze whether or not stakeholders cooperate in restraining from activities that cause degradation of upper Athi River basin. The stakeholders are faced with the following 4 possibilities:

- (a) Everyone follows the rules and cooperates in stopping degradation activities – everybody gets something (**Stop. Stop**).
- (b) No one cooperates and the water resources are degraded, and everyone gets very little benefit (**Continue, Continue**).
- (c) The individual stakeholder does not cooperate while other cooperate the stakeholders maximizes their benefits from the resource kept in condition by others restraint (**Continue. Stop**).
- (d) The individual (stakeholder) cooperates and others do not and the stakeholders get less than they would if others cooperated (**Stop, Continue**).

Table 3. 1: Prisoners’ dilemma payoff matrix

		Stakeholders	
		Stop	Continue
Government	Stop	Stop, Stop	Stop, Continue
	Continue	Continue, Stop	Continue, Continue

Source: Mandani, (2010)

The rationale of Prisoners’ dilemma game would imply that the second alternative (**Continue, Continue**) would prevail as all stakeholders would try to maximize their own benefit (utility) in the short term but in the long term the water resources would be degraded. The implication would be that the group of stakeholders would need coercion (intervention from state) to enforce the rules (Sellammna, 2015).

Prisoners’ dilemma game is applied in this study to analyze the stakeholders’ responses prior and after application of coercion (intervention mechanisms) like fines, incentive and licenses at different levels. This gives the water resource managers useful feedback that would inform new action in management and water resources.

3.5 Study limitations

Due to resource and time limitations the study only covered upper Athi River basin although it would be ideal to carry out a study of the entire basin and a comparative study of all basins in Kenya. The scope of stakeholders interviewed was limited to a sample of primary stakeholders

drawn from WRUAs and CAACs within the geographical limits of upper Athi River basin. It would be ideal to interview the secondary stakeholders including international organizations to obtain further insights regarding factors that influence their participation in water resources management.

3.8 Chapter Summary

The chapter presents the study site and the methodology for addressing each of the study objectives. DPSIR framework is employed to assess drivers of and responses to degradation in upper Athi River basin. WRUAs and CAACs are identified as mechanisms for stakeholders' participation in water resources management in Upper Athi River basin. The factors influencing the participation of members of WRUAs and CAACs are examined through logit regression analysis of their responses in terms of relevance of information, representation, transparency, access to information and accountability.

Stakeholders (Water users) responses to fines, licenses and incentives as policy interventions for ensuring collective action to address the problem of degradation are simulated using game theory based prisoners dilemma model. The results presented in terms of payoffs functions. The functions of these payoff functions inform application of policy and management interventions. The study was conducted within upper Athi River basin where primary data was obtained from satellite imagery and interviews of a sample of 190 WRUAs and CAACs members. The sample was determined randomly at 95% confidence levels. The analysis and discussions of the results is presented in Chapter 4.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the results of data collected and analyzed following the methodology outlined in Chapter 3. Discussions are done in line with the objectives of this study. Section 4.1 presents the assessment of drivers of and responses to degradation of water resources in upper Athi River basin, while section 4.2 provides an examination of the existing policies, laws, and institutional arrangements for stakeholders' participation in water resources management in Kenya. Section 4.3 addresses the factors influencing stakeholders' participation in water resources management in upper Athi River basin. Section 4.4 presents the stakeholders responses to policy interventions for abating water resources degradation in upper Athi River basin. Finally a conclusion of the chapter is made.

4.1 Drivers, Pressures and Impacts of Water Resources Degradation

To assess the drivers of and responses to water resources degradation in upper Athi river basin the DPSIR framework was used. The drivers, pressures, impacts of and responses to degradation of water resources were qualitatively drawn from literature review. Figure 4.1 below presents the results.

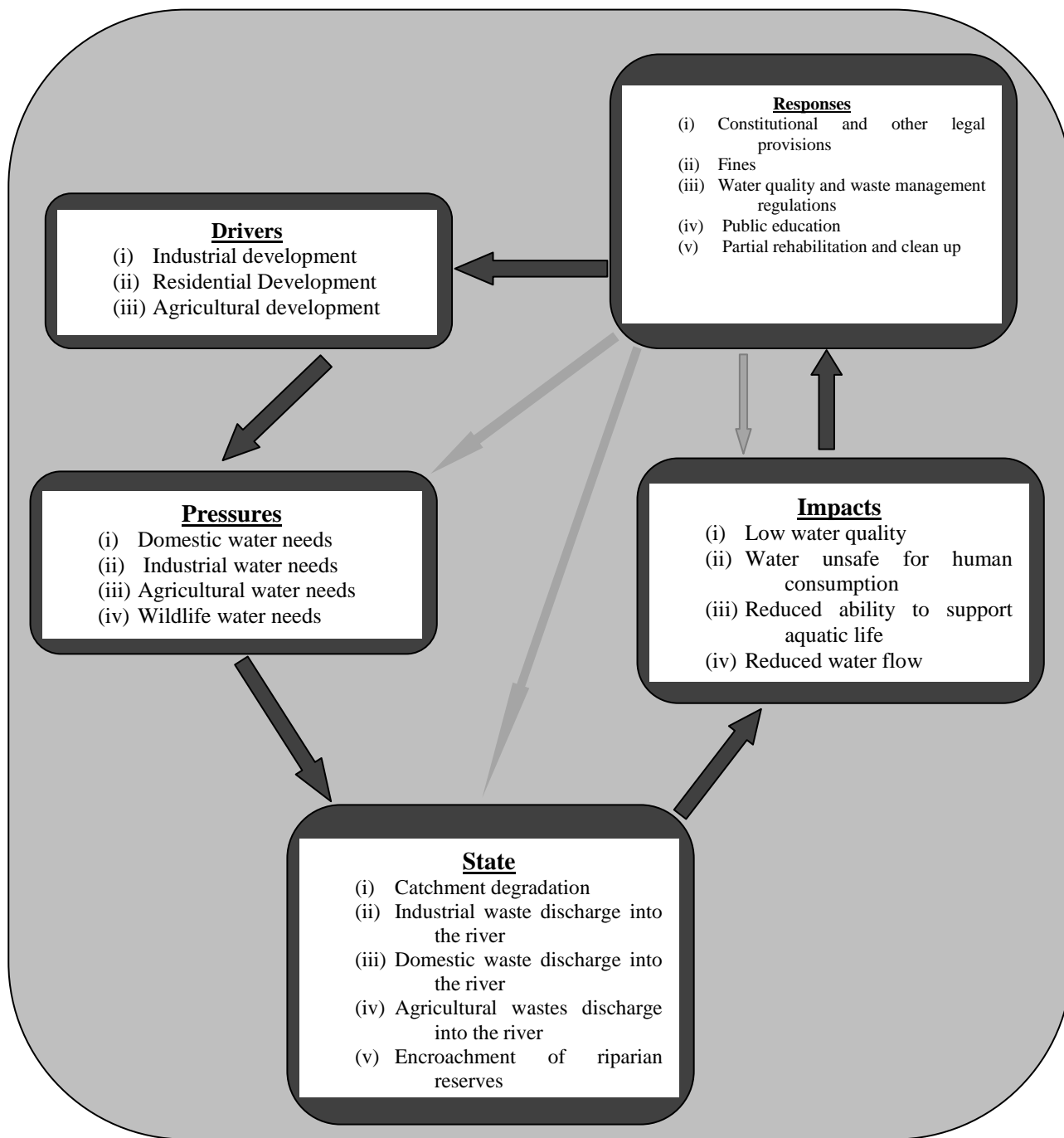


Figure 4. 1: Summary of DPSIR of water resources degradation in upper Athi river basin

Source: Author's Construction

4.1.1 Drivers of water resources Degradation in upper Athi river basin

The key drivers of water resources degradation in Upper Athi river basin are mainly economic (e.g. increased industrial, commercial, residential and agricultural developments) and demographic (from increased population). Water resource degradation studies across the upper part of Athi river basin reveal a close relationship between the types and concentration of potentially polluting substances and specific land use activities (Kithia, 2012). Industrial land uses contribute heavy metals and chemical pollutants; agricultural activities produced pesticide sediments while the residential settlements were associated with human and domestic wastes (ibid). The land cover changes covering the period between 1984 and 2010 of upper Athi river basin indicated expansion of built up areas and agricultural activities at the expense of rangelands which imply loss of vegetation and increased degradation of the catchment area (Katana ., 2013). There has been tremendous decrease in indigenous forests and wetland vegetation in upper Athi from 1948 to 2010 (GOK, 2012). These changes are associated with increased agricultural and urban development activities which in turn have resulted in catchment degradation (ibid).

A baseline pollution levels survey conducted by NEMA on industries within the Nairobi region of Upper Athi river basin indicate that 65% of industries discharging to the environment do not comply with effluent BOD levels set under discharge standards. In addition 75% of the industries did not comply with COD standards (Figure 4.2). The same survey results (Figure 4.3) indicate that 63% of the industries discharging effluent into public sewers did not comply with BOD

standards while 75% were non-compliant to set COD standards (NEMA, 2015). This confirms that industries are a main driver of water resources degradation in upper Athi river basin.

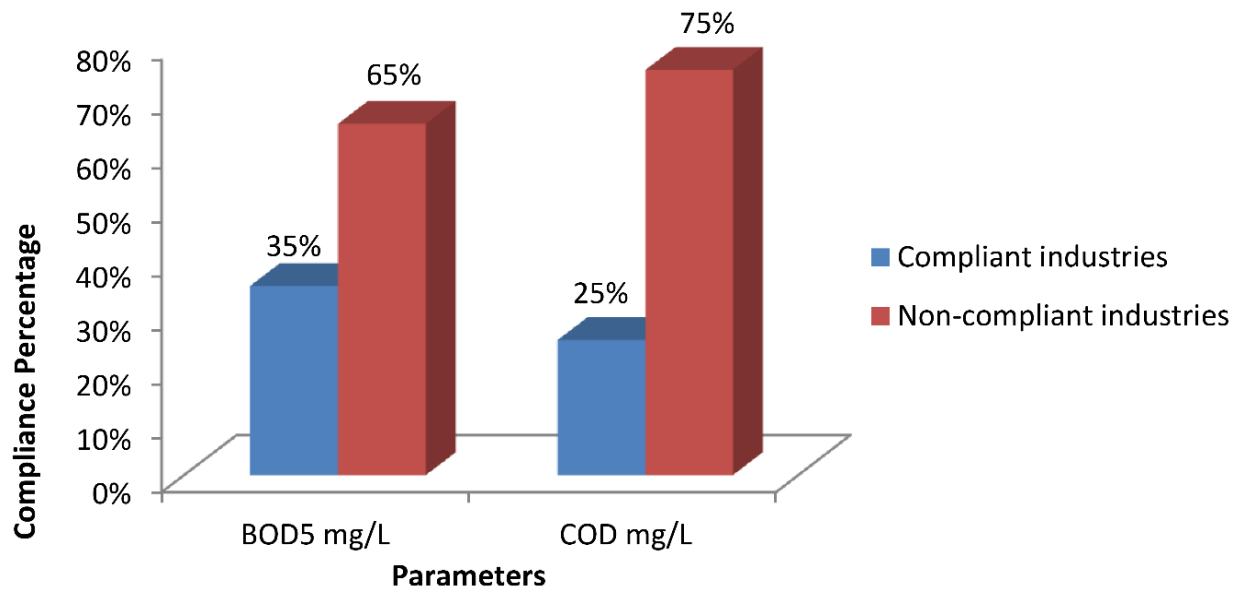


Figure 4. 2: Compliance levels of industries discharging in upper Athi river basin

Source: KNCPC and NEMA 2015.

Earlier Studies conducted by Kithia between, 1999 and 2012 on Nairobi river sub- basin indicate increasing degradation of water resources. Sediments load of this part of Athi river basin is found to be on an increasing trend. This increase in sediments load leads to contamination of water resources. Kithia,(2012) reports Ngong river at Embakasi Bridge to have high loads of polluting substances such as manganese, lead and mercury as a result of industrial activity .From this finding, it is clear that stakeholders engaged in industrial activities are not cooperating in abating water resources degradation. Cooperation of stakeholders engaging in industrial

activities has to be attained either voluntarily or by use of coercion to curtail the actions that lead to release of effluent that compromises the desired state of water resource.

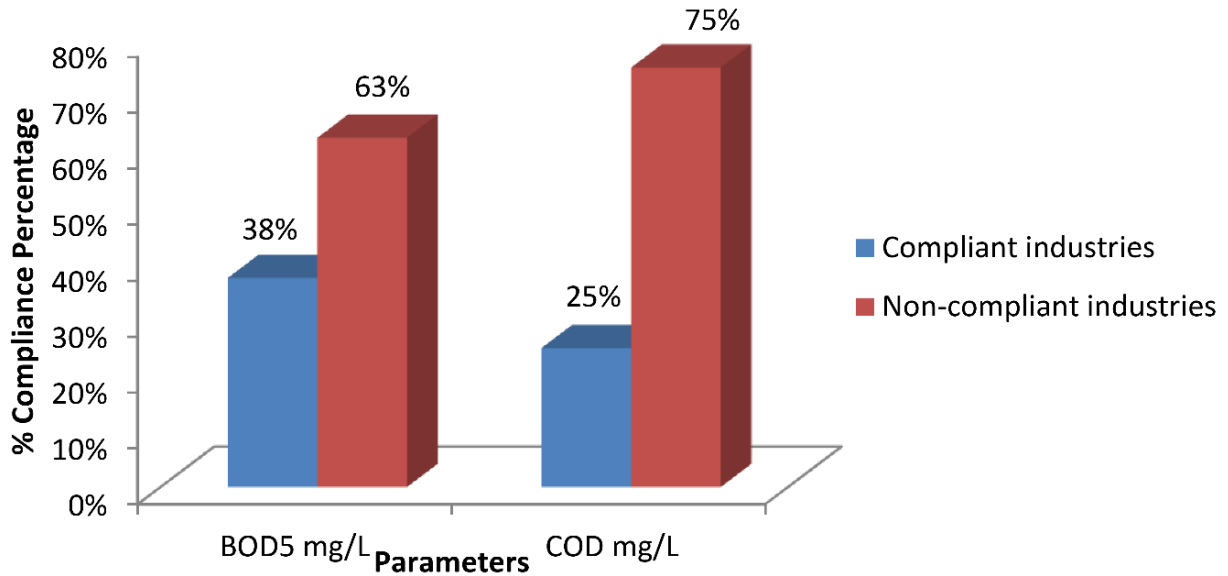


Figure 4. 3: Percentage compliance levels of industries discharging to public sewers

Source: KNCPC and NEMA 2015.

Samples taken from Gitathuru and Ruaka rivers displayed traces of pesticide residues leading to conclusions that there was agricultural pollution contributing to water quality deterioration (ibid). Hadgu . (2013) established that there was untreated waste disposal into Ndarugu river following sampling and testing at different points. They further observed turbidity levels that were beyond WHO limits for drinking water. The analysis done by Kithia, (2012) and the results of tests done by Hadgu . (2013) confirm presence of human wastes in various tributaries of Athi river within the Upper part of Athi river basin. In addition, encroachment of riparian reserves due to expansion of residential developments especially in the informal areas was observed by Karisa,

(2010). These findings point to the fact that residential settlements in the urban areas of the upper part of Athi river basin is among the key drivers of water resources degradation.

GOK,(2012) acknowledges that many informal settlements within the Upper Athi basin are characterized by substandard sanitation infrastructure and discharge their household wastes directly into rivers. Chemical analysis of water samples taken from Mutoine and Ngong rivers in areas adjacent to informal settlements display high levels of human and municipal wastes leading to poor water quality (UNEP, 2005). These points at activities associated with urban settlements as being another driver of water resources degradation. The participation of stakeholders within residential areas is therefore central to addressing the degradation. Measures for curtailing the discharge of domestic wastes and encroachment of the riparian reserves should there designed in a manner that brings forth the cooperation of stakeholders whose activities are situated in residential areas.

WRMA (2015) has cited discharge of agrochemicals (fertilizers, pesticides) from farm lands, and soil erosion resulting from overgrazed agricultural activities as a cause of water resources degradation. Kithia (2012) found evidence for existence of pesticide residues in water in Gatara, Gitathuru and Ruaka rivers. This contributes to water pollution and quality deterioration. Hadgu . (2013) established that there was agricultural waste disposal into Ndarugu river following sampling and testing at different points. They further observed turbidity levels that were beyond WHO limits for drinking water.

Given these findings, it is clear that stakeholders engaged in agricultural activities within the upper Athi river basin have a role to play in abating degradation of water resources. Their cooperation in ensuring that they adopt farming methods that do not apply polluting pesticides; refrain from activities that cause erosion will contribute significantly to sustainable management of water resources.

4.1.2 Pressures on water resources in upper Athi river basin

The approximate population of Athi river basin is 16.7 million and is the highest of the five basins in Kenya. The development needs of this population are therefore important. To meet these needs the use of water resources is necessary. WRMA (2014) observes that the major water users include the urban and rural population, irrigation, industries, livestock and wildlife. This implies that the users and their development needs are the main sources of pressure on water resources in upper Athi river basin.

The per capita water availability for Athi river basin is low. It is estimated at 464M³ per year compared to the global recommended amount of 1,000M³ per year. Given that its per capita water is less than 1000M³, the basin has water supply challenges (WRMA 2012). World Bank (2011) cites the Athi catchment as the only catchment in Kenya having a water deficit in 2010. The Kenya National Water Master Plan (2013) projects a 30% deficit between fresh surface water supply and demand for the Athi River basin by year 2030. The pressure on water resources in the basin from domestic, industrial and other needs will therefore persist. The highest water stress within the Athi basin is experienced within the Nairobi metropolitan area which is situated on the upper part of the basin. The deficit was estimated to be 334,942 M³ per

day (ibid, 2011). The water needs within Nairobi city alone are driven by domestic use (65%) with industrial and commercial uses accounting of the remainder (35%). With the population of Nairobi estimated at 3.1 million, plus the towns covering the larger Nairobi metropolitan, this population is approximately 5 million (GoK, 2009). Therefore, the need to address the water scarcity is more pronounced.

4.1.3 State of water resources in upper Athi river basin

The degradation of water resources is visually manifest in upper Athi river basin. At times organic matter and nutrient loading into the water bodies is high manifesting in black and green colouration in the water. Foul smell and unsightly floating plastics and other solids are a common feature especially in the middle reaches of the river (WRMA, 2014). “Surface water, which accounts for the bulk of Nairobi’s water, is heavily polluted. The pollutants include agro-chemicals, heavy metals, microbial, and persistent organic pollutants” (UNEP, 2007).

Mwangi, (2011) found bacteriological quality of the water as indicated by the total and faecal coliform counts to exceed the standard (OCFU per 100ml) for portable water. The poor quality showed possible contamination with human or animal waste (Ibid). BOD levels recorded around Nairobi City are extremely high peaking at 4,400 mg^l⁻¹ at the Donholm sampling point on the Ngong River and at 2,250 mg/l on the Nairobi river after the central business district, with similarly high values reported on the Mathare river (UNEP, 2007). From the foregoing it is evident that the water resources in upper Athi basin display a state of high levels of degradation.

4.1.4 Impacts of water resources degradation in upper Athi river basin

Water resource degradation was estimated to cost the country at least Ksh3.3 billion annually (Mogaka, 2006). Organic pollutants in the Nairobi River Basin from human and industrial waste results in increased Biological Oxygen Demand (BOD) which leads to the death of aquatic organisms and choking the river system. Water resources degradation affects water quality and availability. The reduced forest covers in Upper Athi has led to increased surface runoff resulting in lower water quality (GOK, 2012). The destruction of surface cover in the catchment area has resulted in reduced recharge thus reducing the water amount available (Wanjohi, 2014).

The organic nutrients coming from municipal sewage and industries promote growth of bacteria whose decomposition results in decline in dissolved oxygen. The inorganic nutrients from agricultural activities also contribute to drop in dissolved oxygen in water (Ondiek, 2015) Organic pollutants in the Nairobi River Basin from human and industrial waste results in increased Biological Oxygen Demand (BOD). The increased dumping of industrial wastes directly into rivers makes the water unsafe for domestic use. It in effect turns water into a health hazard (ibid). Wanjohi (2014) observes that sediments resulting from soil erosion, mining and construction activities reduces water flows adversely affects its quality, causes siltation. and increases water infrastructure maintenance costs. It is therefore evident that water resources degradation inhibits the ability to supply water to drive economic activities, preserve biodiversity and sustain livelihoods.

Water being a “fundamental human need, a human right and an essential element in the maintenance of biodiversity and cultural diversities should be sustainably managed” and

therefore effective measures for addressing the problem of degradation should be established (Ameriso, 2013). Given that human activities have been cited above as having a close relationship with water resource degradation, the measures for addressing degradation have to be designed with full and effective participation of stakeholders (persons) carrying out those activities or influencing the way they happen. WRMA (2015) cites the role of water users, riparian land owners and other stakeholders as being key to addressing the problems of water resources degradation.

4.1.5 Responses to Water Resources degradation

Addressing degradation of water resources requires strategies to prevent, treat or remedy. Prevention of degradation (pollution) or removal of pollutants at source before they discharged is the cheapest way to protect resources (Meena, 2010). It is however observed that most governments have focused more at individual “point source” polluters who are easier to deal with than “non-point source” polluters. Comprehensive and effective approaches and policy interventions for addressing this problem holistically are therefore necessary.

Singh, (2009) classifies these policy interventions into four categories namely; “institutional changes; direct controls and regulation; economic market based instruments and technological measures”. Robinson and Ryan (2002) also classify them as “command and control regulation, financial and market based incentives as well as moral persuasion approaches”. Meena (2010) classifies them to include “technological tools and approaches; non-physical approaches like pricing, economic incentives and legal regulatory tools; approaches for restoration of water quality and watershed systems”. Below is a brief discussion of these measures.

4.1.5.1 Institutional instruments

Constitutional provisions, formation of new institutions, reforming existing institutions and enacting new laws are placed in this category (Singh, 2009). In Kenya this is reflected in the passing of constitution of Kenya 2010 which places the right to a health environment as a right and makes breach actionable. The establishment of the environment and land court; the revision of the water Act and the Environment management and coordination Act comprise institutional instruments. Kenya is also carrying out devolution of functions and re-aligning of the institutional frameworks to the new constitutional order.

4.1.5.2 Direct controls and Regulation

The extent to which water degradation is addressed by legislation and regulations varies widely among different countries and regions. It ranges from water pollution control regulations to a comprehensive policy framework and regulations. A strong policy and regulatory framework is necessary as a first step in effectively addressing water resources degradation (Meena. 2010).

Concurrent formulation of policy and harmonization of laws with other existing laws is necessary to avoid institution disputes in implementing and enforcing regulations as witnessed between NEMA and WRMA (WRMA, 2015).

Kenya has put remarkable effort with regard to developing this measure as a means of combating degradation. This is evidenced by passing of legal notices No. 120 and 121 of 2006 on water quality regulations and waste management regulations respectively (GoK, 2006). Good, enforceable regulations must be supported by all stakeholders for the desired results to be

attained. Poorly designed regulations cannot adequately address water degradation problems (Meena, 2010). This assertion makes the concern addressed in this study on the responses of stakeholders to policy interventions relevant. The effectiveness of regulations and controls will depend on how they relate with the contextual and behavioral realities displayed by the stakeholders (users).

Ribson and Ryan (2002) observe that command and control approaches can lead to complex legal and regulatory regimes that are hard to apply. The in turn make enforcement and monitoring very expensive and could lead to corruption. WRMA has been undertaking pollution surveys on their own initiative or upon public complaints. In year 2014/2015 a total of ten surveys and compliance inspections had been done within upper Athi river basin. Only one out of the 10 institutions inspected was found to have fully complied with effluent discharge regulations. WRMA officials indicated that legal action was to be taken against those found in breach of the set regulations. Indeed WRMA (2015) confirms that it faces inadequate support from law enforcers in enforcing regulations. Modest compliance with regulations by water users regarding abstractions and effluent discharges is experienced. The indication that funds for financing pollution control are raised from the exchequer and development partners (WRMA, 2015) validates the financial burden on the government associated with employing this intervention.

4.1.5.3 Water quality standards:

Kenya has established elaborate water quality standards for domestic, agricultural, industrial, recreational and other users (GoK, 2006). It is however necessary that stringent monitoring is undertaken and that regular review is done to address emerging risks. Key informants interviews carried out indicate that the sub regional offices in upper Athi basin have been undertaking routine flow and sampling at designated points. The monitoring is done for Nairobi river at Museum hill and Juja farm; Ruiru at Ruiru town; Kamiti river at Brookside; Kiu river at Githurai; while other monitoring points are along Thiririka, Ndarugu, Ruaka and Ngong rivers. The data collected is used to inform planning and enforcement of water regulations. In addition to monitoring, strict enforcement of the standards and penalizing those in breach is key to the successful use of quality standards in addressing water resource degradation. WRMA, (2015) has cited in adequate support from law enforcers as a major challenge in addressing water resources degradation.

4.1.5.4 Economic / Market instruments

Economic instruments such as taxes, subsidies, pollution charges and fees have the potential to make pollution control economically advantageous to water resource users and lower abatement costs. (UNEP, 2004). Despite the numerous advantages of economic instruments they also have limitations. Their effects on environmental quality are not as predictable as those under regulatory approach; some polluters may also opt to pollute and pay charges if the charges are not set at the appropriate levels; the instruments require sophisticated institutions to implement. (Bernstein,2002). There could be political influence not to tax polluters or to impose low taxes

which do not cover all the external costs. In addition fixing socially optimum tax rates introduces difficulties in measurement of the extent of emission and their valuation (Singh, 2009).

The potential efficiency of economic instruments should be balanced against the constraints cited above, including policy baselines, institutional weakness, legal gaps or strong political opposition (UNEP, 2004). Indeed this consideration would be important for Kenya which has largely depended on the command and control and regulatory instruments. A review of the legal framework points to very limited embrace of economic instruments. EMCA 2000 has however provided for discharge and emission licenses under sections 75 and 80 respectively. The amounts payable for these licenses have been set under the Eleventh schedule of the water quality regulations. The water Act 2002 also provides for licensing of water service providers. The providers are allowed to charge for water services. (GoK, 2000, GoK 2002, GoK, 2006).

Despite having these provisions the potential for application of diverse economic instruments is limited by lack of relevant statutory provisions enabling their comprehensive and effective application. Further the levels of charges fixed for emissions licenses and charges for effluent discharges are not reflective of market realities and may offer incentives for degradation of water and environmental resources. The behavior of the polluters (users) as economic agents within dynamic market and social realities is not addressed by the policy or legislative measures adequately. The mechanisms for having them to internalize full degradation (pollution) costs are not in place. Measures for pollution taxation, economic incentives for cleaner production by industries and subsidies to encourage sustainable agricultural production methods are not evident.

4.1.5.5 Technological production

Measures could be used as both preventive and curative to degradation. Singh, (2009) observes that despite most degradation problems being associated with human behavior and attitudes towards the environment, some issues could be addressed through technological measures. Pollution of water bodies and land could be addressed by use of organic manures, organic pesticides and adoption of organic farming (Ibid). Kithia (2007) recommends that the ministry in charge of agriculture should promote the adoption of non-polluting pesticides and farming technologies to address degradation of water resources within the Nairobi sub basin.

Afforestation of degraded land could be effective in addressing degradation of catchment areas. (Singh, 2009). Katalina . (2011) confirms that degradation of Aberdare range within the upper Athi river basin has reduced with the increase of forest cover. Kithia (2007) observes that buffer zones created along river systems can help in reducing degradation of water resources. Provision of adequate drainage and sewerage infrastructure would reduce direct discharge of human wastes into rivers in informal settlements (ibid).Cleaner production technologies could address the reduction of industrial discharges and emissions that degrade water and the environment generally. Appropriate technologies can be used to treat water and make it available for reuse (Singh, 2009). UNEP (2004) calls for use of technologies and infrastructure to prevent, treat and restore water quality in every region of the world (UNEP 2004). Despite this call, there is little evidence of adoption of these technologies in Upper Athi River basin. The adoption of such technologies in upper Athi River basin and Kenya would require policy anchoring and requisite incentives to encourage their adoption by stakeholders (users).

4.1.5.6 Public education

EMCA Amendment Act 2015 gives NEMA the duty to carry out environmental education and public awareness (GOK, 2015). However there is no evidence for robust well planned and financed program for implementing this provision. Similarly the coordination of this effort between NEMA and WRMA is not evident within the study area. This measure should be employed by WRMA and NEMA to enhance public support and prevent degradation that arises from ignorance.

4.1.5.7 Consumer and investor pressure

Pressure from consumers and investors on the private sector can provide a useful leverage for water degradation abatement. This pressure takes the form of consumer boycotts and media campaigns that publicizes poor practices for those causing pollution or degradation of water resources to the detriment of communities. These actions can cause change of company policy and may improve water management practices (Meena, 2010). Strategic partnerships by WRMA and NEMA with the media and consumer organization can help in developing this strategy especially where pollution and degradation can be attributed to particular industries or investors. This may face limitations if those companies are major advertisers with the media companies. Community media may be the route to use in addressing this challenge.

4.1.5.8 Changing Social Norms

Changing the unwritten rules that normally influences everyday choices of individual, firms and groups can be employed as instruments for preventing degradation and pollution of water

resources that arise from their negative application (Meena, 2010). Environmental movement combined with institutional changes has for instance resulted in adoption of recycling as a norm in many countries (Ibid). Wide spread adoption of water hygiene and sanitation could be driven by changing social norms especially in urban settlements (Ibid). The state of degradation observed in the Upper river basin does not attest to any consistent changes in behavior of individuals or firms towards abating degradation of water resources.

Adoption of this measure would for instance be useful in combating degradation arising from urban settlements within the upper Athi River basin associated with waste disposal.

4.1.5.9 River clean up and awareness campaigns

WRMA officials interviewed indicated that they have been conducting river clean up and awareness campaigns. The clean-up for Kiu river at Githurai in year 2014 was cited as an example. Other cleanup activities are carried out by neighborhood associations and volunteer groups on an adhoc basis. There is need to intensify these campaigns and have river clean up planned at a basin wide level

4.1.5.10 River rehabilitation/restoration projects

The government has undertaken projects in partnership with other stakeholder to restore rivers and water infrastructure with the aim of addressing water resources degradation. The notable such project is one undertaken in partnership with UNEP to restore the Nairobi river between 1999 and 2009. Such projects have taken the nature of clean ups followed by planting of trees along the riparian reserves. Others initiatives under this category have included rehabilitation of dams such as Nairobi dam and the rehabilitation of sewerage infrastructure. This has been undertaken using governments own resources or with external financing. WRMA indicates that the afforestation of the Nairobi basin riverine was successfully undertaken. At the time of the interview there were plans by WRMA to implement the Athi river restoration program.

From the foregoing it is evident that the government together with other stakeholders have made some efforts to respond to the degradation of water resources within the upper Athi river basin. It is however clear that the initiatives are not comprehensive and have taken a piece meal approach. The indication that 90% of the institutions surveyed by WRMA in the period 2014/2015 had not complied with discharge regulations confirm that the current strategies for addressing the problem are not effectively working to yield sustainable management of water resources. The interview results together with literature review reveal an over reliance by the government on regulations and the expectation that enforcement will be effective. Indeed the assertion by WRMA officials that they will result to legal action points at their success depending on the effectiveness of the prosecution and judicial systems. This success appears to be limited according to review of reports issued by WRMA in 2015 cited earlier in this study which indicate that enforcement agencies have displayed laxity. The reports have also cited challenges

in financing programmes and initiatives of halting or reversing water resources degradation. It was evident that after the completion of the UNEP supported Nairobi river restoration program the other initiatives have been small scale and on an adhoc basis and the explanation given was financial resource limitations.

The interview results and literature review also reveal that economic instruments and other non-command and control approaches have not been employed other than public awareness (education). The public awareness campaigns appear to be linked to clean up exercises rather than on being on a continuous basis and thus limited in attaining cultural and behavioral changes. Therefore, the responses available for addressing the problem of water resources degradation depend on participation and cooperation of numerous stakeholders.

4.2 Existing policies, laws and institutional arrangements for stakeholder participation

4.2.1 Policies guiding stakeholder participation

Stakeholder participation in water resources management in Kenya has been guided by the provisions of sessional paper No.1 of 1999 on National policy on water resource management and development. The policy specifically provides for stakeholder participation in water development projects and recognition of gender aspects in water use and management. The policy further provided for decentralization of water management through institutional reforms (GOK, 1999). Mathenge, (2014) sums the reforms as covering the following four themes: “decentralization of functions to lower level state organs; the involvement of stakeholders in the management of water resources and in the provision of water services; the separation of the

management of water resources from the provision of water services; and, the separation of policy making from administration and regulation”.

The policy provided for the adoption of integrated water resources management while acknowledging that the sector had been adversely affected by fragmented approaches by sectoral agencies (GOK, 1999). This adoption of IWRM provided a key foundational thrust upon which stakeholder participation has been pegged. The provisions of this policy were given legal force by the Water Act 2002 and have been implemented since then. Following adoption of the Constitution of Kenya 2010, and experience drawn from two decades of implementation of the water policy of 1999 the need for water policy emerged. New constitutional values, responsibilities and obligations required new policy directions. This need led to the formulation of draft National Water Policy 2012. The draft National Water Policy 2012 seeks to build on the success achieved by the 1999 policy and address the emerging challenges while ensuring constitutional alignment. GOK,(2012) cites some of the challenges as being the incomplete devolution of functions to the basin level in water resource management and conflict of interests in regulation and implementation.

The draft policy adopts IWRM and participatory approach among key principles in addition to highlighting the need to increase public participation and its institutionalization (GoK, 2012). These provisions provide a more focused guide to stakeholder participation in comparison with the provisions of the 1999 Water policy. In addition to the water policy, the National policy on environment has also been adopted. This policy is geared at making constitutional provisions operational and has one of its objectives as promoting and enhancing cooperation, collaboration, synergy, partnership and participation in protection, conservation and better management of the

environment by all stakeholders. It further provides for the principle of public participation and inclusivity. (GoK, 2014). It is clear from the provisions of the draft national water policy 2012 and the environment policy 2014 that the provisions of Constitution of Kenya 2010 serves as the anchor for stakeholder participation. The section below reviews the constitutional provisions that relate to water resources management and stakeholder participation.

4.2.2 Constitutional provisions guiding stakeholder participation

The Constitution of Kenya 2010 provides that “all Sovereign power belongs to the people and this is to be exercised in accordance to the provisions of the constitution”. It further provides “democracy and participation of the people; good governance; integrity; transparency; accountability and sustainable development as national values” guiding how the power of the people is exercised (GOK, 2010). This gives stakeholder participation the highest legal recognition in the country.

The rights of people to access water and participate in environmental management issues have severally been anchored in the provisions of constitution of Kenya 2010. Water has been recognized as a basic human right (Article 42). Article 43 (1) (d) affords “every person a right to clean and safe water in adequate qualities” (Ibid). This provision makes the responsibility of addressing the problems of water quality and quantity not just discretionary but mandatory obligation for the state. It affords people the basis for seeking redress in case of failure by the state authorities to secure this right. The implication is that state authorities have to invest in approaches and management mechanisms that deliver these rights to avoid high judicial costs in case of breach. These two provisions put pressure on the state to implement management

approaches like IWRM that are designed along the principles of sustainable development. They provide the foundation for deriving authority to develop policies and institutions for securing rights to water among other environmental resources.

Articles 69(1)(a) gives the state the duty to “ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources and ensure equitable sharing of accruing benefits” (Ibid). This provision correlates with the concepts of sustainable development and IWRM highlighted earlier. It specifically brings to the fore the duty of addressing equity among the current generation and for the future generations. Under Article 69(1) (d), the state has the duty of “encouraging public participation in the management protection and conservation of the environment” (Ibid). This provision makes public participation not just a normative goal but a duty that has foundations for being institutionalized. Again this is in agreement with participatory requirements for IWRM. It is therefore necessary that water resource management policies and strategies sets mechanisms for ensuring effective participation at all levels of governance.

Article 69 (2) places on every person “the duty to cooperate with state organs and other persons to protect; conserve the environment; ensure ecologically sustainable development and use of national resources” (GoK, 2010). This provision is useful since it gives responsibility to all members of the public to co-operate. It is critical in cases where regulations have to be enforced for the collective good of the public; collective action necessary for sustainable management of water resources can be enforced under this provision. The constitution provides for devolution by creating forty seven 47 distinctive county governments. A key object of devolution is outlined in art 174 (c) as being “to give powers of self-governance to the people and enhance participation of the people in the exercise of powers of the state and in making decisions affecting them”.

Article 174 (h) makes decentralization of state organs, their functions and services an object of devolution.

County governments are additionally required by schedule four part 2(14) to ensure and coordinate the participation of communities and locations in governance at the local level and assist them to develop administrative capacity for the effective exercise of functions and powers and participation in governance at the local level. These provisions suggest that devolution is intended to realize the principle of subsidiarity and are a kin to the provisions in principle 10 of Rio Declaration. The provisions provide a basis for enhanced role of the public in environmental decision making (Kibugi R, 2014). With the duty and responsibility to environmental management under Art 69 (2) cited earlier, all stakeholders have an obligation to effectively participate in ensuring sustainable management of water resources in Kenya.

Given the foregoing constitutional provisions, the general public is also required to fulfill the duty of protecting the environment and ensuring sustainable development and use of natural resources. They cannot therefore sit back and watch as degradation of the environment and misuse of natural resources goes on (Muigua, 2014). The constitution being the supreme Law in Kenya has therefore comprehensively framed the role of citizens in water and environmental resources management. It has afforded a social contract to the citizens that guarantees sustainable development and consolidates their roles in its achievement. The broad constitutional principles and values discussed above require more a specific statutory framework to direct their implementation. The section below reviews the legislation that addresses stakeholder participation in water resources management.

4.2.3 Legislation governing stakeholder participation

Legislation governing stakeholder participation is discussed below under three categories covering legislation on water resource management; legislation on environmental management and legislation on county government.

4.2.3.1 Legislation on water resources management

The Water Act 2002 was enacted to provide a framework for implementation of the reforms encapsulated in the 1999 national policy on water resources management and development. Section 7 of the Act established the water resource management authority (WRMA), while section 8 provided for its powers and functions. Of key relevance to this study is section 8(1)(c) which gives WRMA the powers and functions of regulating and protecting water resources quality from adverse impact. In addition section 8(1) (f) gives the authority power to manage and protect catchment areas. Under sections 14, 15 and 16 the authority is given powers to designate catchment areas, formulate catchment areas management strategies and form catchment area advisory committees. (GoK, 2002). These provisions provided location for making IWRM strategies operational, with the catchment area (Hydrological Unit) being used to organize water resources management rather than follow administrative or political units. Stakeholder participation is provided for in the Act under section 107, where specific procedures for undertaking public consultations are prescribed. This is an important provision since it opens up space for public voice and provides an avenue for public input to water management decisions. Section 16 provided for establishment of catchment area advisory committees with the appointment procedures for the member being prescribed by the first schedule. These committees were charged with the duty of advising WRMA officers at the regional offices “on matters relating to water resources conservation, use and apportionment; the grant, adjustment,

cancellation or variation of any permit and any other matters pertinent to proper management of water resources” (GoK, 2002). The Catchment Area Advisory Committees were thus set to provide the highest level at which stakeholders were expected to inform the water management strategies. This provision afforded an avenue for the committee members to inform the decisions of the regional officers. The question as to whether the committees have effectively played this role is a subject that this study addresses. It is expected that the committee members will act as representatives of stakeholders.

Section 15 (5) of the water Act 2002, provided for “establishment of water resource users Association (WRUA) as a platform for conflict resolution and cooperation in management of water resources”. These associations have been providing a platform for stakeholders to participate in management of water resources. This provision did not make the establishment of WRUAs mandatory but only required WRMA to encourage their establishment through the Catchment management strategy.

After the passing of the constitution there has emerged need for all law to be aligned to the provision of the constitution and the water Act 2016 has been enacted to address this gap. The law that addresses general public participation set standards and provides a framework for all public institutions is yet to be enacted. This framework would be a guide on the information needed; determination of suitable media, forum, methods for participation; time frames; levels of engagement; process sequencing and other quality issue (Muigua, 2014).

The water Act 2016 “provides for regulation, management and development of water resources, water and sewerage services and other related purposes” (GOK, 2016). The Act separates the regulatory and management functions of both water resources and water use. Section 11 establishes water resources regulatory authority sections 12 and 13 give the functions and powers

of the authority respectively. These provisions present a departure from the combination of regulatory and management of water resources and management of water resources function under one body (WRMA) under the provisions of the 2002 water act. The Act recognizes basin areas as defined areas from which rain water flows into a water course and designates these basin areas as management units for water resources section 25 provides for the establishing of basin water resources committee with the responsibility of management of water resources within the respective basin. (GoK, 2016). This differs from the CAAC under the water Act of 2002 which only played an advisory role.

Section 26, together with the first schedule has made attempts to address the imbalance in representation of various stakeholders earlier witnessed under the regime of water Act of 2002. The process adopts the values provided for under Article 10 of the constitution. Section 29 of the Act provides for establishment and functions of water resources users associations at the sub basin level. The WRUAS shall be a community based association for collaborative management of water resources and resolution of conflict concerning the uses of water resources. (GoK, 2016). There is still discretion left to the basin water resources committees to contract WRUAS as agents to perform certain duties in water resources management. The draft policy and statutes cited above do not address negative competition for water resources. Their implicit assumption is that given the public participation structure and strategies proposed, voluntary collective action that pursues goals of sustainability will take place.

4.2.3.2. Legislation addressing environmental management

Besides the water Act of 2002, Section 3 of EMCA of 2000, created a " liberal legal standing (access to justice) for anyone bringing an environmental action (Kibugi, 2014). This correlates with provision requiring access to judicial and administrative proceedings, including redress and remedy as advocated for by principle 10 of Rio Declaration.

EMCA provides for public consultation as part of Environmental Impact Assessment procedures (GoK, 2003). This internalizes consultation and representation as forms of public participation (Kibugi, 2014). These aspects of public participation though limited in scope, generally opened up the sphere of stakeholders' participation in environmental and water management decisions in Kenya.

Revisions to EMCA, have also been made. The Environmental Management and Co-ordination (Amendment) Act 2015 has been enacted and came to force on 17th June 2015. The 2015 amendments to EMCA have generally sought to align the year 1999 Act to the provisions of the 2010 Constitution. It aligns with the provisions on the bill of rights with respect to people's rights to a clean and healthy environment. It further amends section 3 of the principal Act to open up space for people to take judicial action with respect to violation of environmental rights on their own behalf, on behalf of others or in public interest. This aligns with the constitutional guarantees for access to justice. A new section 3A is introduced to provide for access to information that is in the possession of NEMA, lead agencies or any other authority. This again aligns with the right to access information accorded by the constitution. This makes operational a key element of effective stakeholder participation in environmental management and decision making. Section 5 of the principal Act is amended to require "the cabinet secretary to provide evidence of public participation in formulation of policy and environmental action plan". This

again is a progressive provision seeking accountability of the policy office in the sector with respect to public participation. Section 9(m) is amended to require NEMA to undertake and enhance environmental education, public awareness and public participation (GOK, 2015). Sections 29 and 30 are repealed with new provisions being made establishing County Environmental Committee and providing for its functions respectively (Ibid). Though section 27 is providing for diverse membership of the committee and putting consideration to gender balance and representation of persons with disabilities and minorities it fails to seek competitive recruitment or election of members. The duty of appointment is left to the governor.

A new section 57 A is inserted in part IV of the principal Act providing for a requirement of Strategic Environmental Assessment to be carried out on all policies, plans and programs. The guidelines for those assessments are subject to stakeholder consultations. Again this brings accountability on the part of government authorities with respect to ensuring sustainable development. Section 71 of the principal Act is repealed and replaced with a new section that places the duty of setting water standards on the cabinet secretary on recommendation of NEMA. The new provision eliminates the enforcement and review committee thus reducing bureaucracy.

4.2.3.3 Legislation on participation at the count levels

Other than the sector specific legislation discussed above, it is important to cite that the County Government Act 2012 makes provisions that give specific guidance as to how public participation should happen. Part two of the County Government Act 2012 requires the County Governments to ensure efficiency, effectiveness, inclusivity and participation of the people in their discharge of duties (GOK, 2012). The Act further enumerates in detail the principles of

citizen participation under section 87 that largely align with the requirements of the Constitution of Kenya 2010 with respect to public participation including access to information; diversity across gender, communities and generations; judicial redress; adherence to requirements for sustainable development (Ibid). These statutory provisions afford the County Governments sound foundation for ensuring effective stakeholders participation as they implement national government policies with regard to water and environmental management. It is therefore within the scope of the Counties of Kiambu, Machakos and Kajiado whose jurisdiction cover the Upper Athi river basin to place the agenda of sustainable water resources management within their development programmes and rally all stakeholders to support it.

The provisions contained in the various statutes and the proposed amendments reviewed above largely correlates with the elements of participation scoped by the Rio Principle 10 as well as the principles of sustainable development highlighted earlier. It is however important to review the institutional arrangements that are put in place to implement the cited provisions to ascertain their efficacy.

4.2.4 Institutional arrangements for stakeholder participation

The institutions for stakeholder participation may be scoped from the discussion above on policies, constitution and legislation. These are institutions whose functions relate directly or indirectly with how citizens make decisions with respect to water resources management; obtaining of information; and access judicial or administrative proceedings. Schedule four of the Constitution of Kenya 2010 places the duty of protection of the environment including water under the national government. In addition the function of making policies on natural resources

and environmental protection including water conservation is assigned to the national government. The county governments are assigned the roles of implementing the specific national government policies (GOK, 2010). Below is a detailed discussion of the institutional arrangements at each of the levels.

4.2.4.1 National government policy and oversight institutions

From an institutional point the National government ministries making decisions on environment and water resources policies are the main entries at which stakeholder participation ought to take place. Section 4 of the Water Act of 2002 gives the cabinet secretary (Minister) power to exercise control over every water resource. The cabinet Secretary has the duty of “promoting the investigation, conservation and proper use of water resources throughout Kenya and to ensure the effective exercise and performance by any authorities or persons under the control of the cabinet secretary of their powers and duties in relation to water” (GOK, 2012). The executive through the ministry is also expected to engage stakeholders in discussions and formulation of policies and strategies relating to water resources development and management. The Water Act of 2002 under section 11 that requires “the cabinet secretary, following public consultation, to formulate, and publish in the Gazette, a national water resources management strategy. “The strategy prescribes the principles, objectives, procedures and institutional arrangements for the management, protection, use, development, conservation and control of water resources in Kenya” (GOK, 2012).

The formulation of the draft water policy 2012 is cited as being the result of a comprehensive discussion with stakeholders. The discussions took the form of retreats, meetings, specialist technical consultations and workshops (GOK, 2012). Similarly the draft national environment policy 2013 details its formulation as originating from wide participation and consultation with various stakeholders comprising the academia, non-governmental organisations, interest groups, government ministries, relevant public and private sector organisations (GOK, 2013).

This assertion by the ministries that the formulation of the policies was participatory does not however detail how adequate representation was achieved across generations, gender and social strata. Once policies are formulated by the executive, they are forwarded to parliament for debate and approval. The institution of parliament that includes the national assembly and the senate therefore serves as another national level platform where stakeholder participation is expected to occur. This participation would take the nature of submission of memoranda and oral presentation before the relevant committees. The draft water policy 2012 and draft national environment policy 2013 were yet to be subjected to public participation at the parliamentary level at the time of writing this report. As earlier observed there is still no national framework law for public participation in Kenya and therefore these processes are left to sectoral specific laws and discretionary administrative procedures.

4.2.4.2 County Government executive and oversight institutions

Given the provisions of the County Government Act cited earlier in section 4.2.3, all county government institutions are obliged to facilitate effective stakeholder participation. The county

government executive committee is therefore the apex institution that is expected to implement those provisions. The county executive committee member in charge of the department responsible for water and environmental matters is therefore expected to spearhead the implementation of programmes and projects aimed at protecting and conserving water resources in a manner that is participatory.

It has however been observed that counties have variably implemented the public participation requirements under the County Government Act 2012. Some like Makueni have established robust and clear public participation frameworks while others like Isiolo have only scattered administrative notices inviting public participation limited to their budget formulation processes (IEA,2015).

It is therefore necessary that all county governments put in place clear frameworks for public participation. The executives in charge of water resources management should implement these frameworks to enhance stakeholder participation in the implementation of IWRM at the lowest levels of the devolved government.

The authority derived from article 185 of the Constitution of Kenya 2010 and County Governments Act 2012 gives County Assemblies the duty of debating the frameworks, projects and work plans and budgets from the county executive committee members, approving them and playing oversight roles with respect to their implementation. This authority includes matters relating to water management and conservation. In performance of these duties the county assemblies are also required to allow for citizen participation. In this respect, on matters relating

to water resources management, the assemblies have a duty to ensure effective participation of stakeholders in the processes of decision making at the assembly level and the implementation processes undertaken by the executive.

Besides the general review of national and county government institutions it is important to review the water sector specific institutions that afford stakeholders mechanisms for participation in water resources management in Kenya.

4.2.4.3 Water Resources Management Authority (WRMA)

The Water Resources Management Authority (WRMA) was established by provisions of Section 7 of the Water Act 2002 as a body corporate. It was directed by a governing board consisting of the chairman who is appointed by the president and ten other members appointed by the minister. WRMA is bestowed the duties of “development of principles, guidelines and procedures for the allocation of water resources; monitoring, and from time to time re-assessing, the national water resources management strategy; receiving and determining applications for permits for water use; monitoring and enforcing conditions attached to permits for water use; regulation and protection of water resources quality from adverse impacts; management and protection of water catchments; determination of charges to be imposed for the use of water from any water resource; gathering and maintenance of information on water resources and from time to time publishing forecasts, projections and information on water resources; liaison with other bodies for the better regulation and management of water resources; and, advising the cabinet secretary concerning any matter in connection with water resources” (GOK,2012).

Given these wide functions, it is overt that WRMA has been the central organisation for implementation of IWRM. Effective and meaningful participation of stakeholders in the performance of these functions is therefore critical. The actual and strategic participation of stakeholders taking part at policy and operational levels of WRMA, under clear mechanisms and procedures, is important in achieving sustainable management of water resources in Kenya. Protection of water resource quality from adverse impacts and protection of water catchments would for instance be effectively achieved if all stakeholders would play positive roles and cooperate with WRMA in the endeavours to perform its functions. Degradation of water resources by some of the stakeholders (users) would be tamed if their cooperation is ensured.

Section 15(1) of the water Act 2002 required WRMA to formulate a catchment management strategy for the management, use, development, conservation, protection and control of water resource within each catchment area following public consultation. This strategy is among other issues required to provide mechanisms and facilities for enabling the public and communities to participate in managing the water resources within each catchment area under the provisions of section 15(3). In addition section 15(5) of the same Act required “the catchment management strategy to encourage and facilitate the establishment and operation of water resources users associations as for conflict resolution and co-operative management of water resources in catchment areas” (GOK, 2012).

These provisions provided the pivotal link between WRMA and stakeholders in the management of water resources. It is important to analyse how this stakeholders’ participation has been

implemented and establish any arising gaps. It is in addressing these gaps that contribution to attaining sustainable management of water resources would be made. On its part WRMA has been implementing this provision through Catchment Area Advisory Committees (CAACs) and Water Resource Users Associations (WRUAs) (WRMA, 2013). The sections below review how these two institutions have been set up and operated.

4.2.4.4. Catchment area advisory committees

Catchment Area Advisory Committees(CAACs) were established by WRMA under the provisions of section 16(1) of the Water Act 2002 which required it “in consultation with the cabinet secretary to appoint a committee of not more than 15 members in respect of each catchment area” .The catchment area advisory committees had the duty of advising the regional office of the catchment area for which they are appointed, in matters concerning; “water resources conservation, use and apportionment; the grant, adjustment, cancellation or variation of any permit; and any other matters pertinent to the proper management of water resources” (GOK,2012). The CAAC members were drawn from among various stakeholders including government officials, representative of farmers or pastoralists, business, community, and NGOs engaged in water resource management programmes within a catchment area (ibid). Kibugi,(2015) observes a key gap in relation to the formation of the CAAC where the law did not specify the proportion of members of the public relative to co-opted public officers. This made it difficult to assess how the public representatives would impact the threshold of decision making in the mandate of CAAC (Ibid).

The appointment of CAAC members by the minister as provided under the first schedule of the Act did not provide any direct public role in the process. As much as the members are referred to as public representatives; their appointment by the minister rather than election by local community, nullified the argument that they were representing the local community interest (ibid). In addition, the process was silent on how questions of gender and age equity were to be satisfied in constituting the committee. The role of the CAACs as provided for in the Water Act of 2002 was advisory. Whether their advice was taken up and heeded by the regional office of the authority was a matter left to the discretion of the regional office and the authority. There was also no legal obligation on the part of the authority or the regional office of the authority to give any feedback to the committee members regarding the advice that they had given. This gap left room for the regional offices and or the authority to proceed with implementation of water resource management strategies or decisions even in instances where they may have disregarded relevant advice of the CAACs. The performance of the CAACs was also left to be monitored administratively and is not legally pegged to any form of objective appraisal mechanisms or standards. This created room for the CAACs to operate without accountability to the larger body of stakeholders and the public that they are meant to be representing.

It is worth noting that the “Water Act 2016” has provided for the establishment of Basin area water resources committees to replace the CAACs. These committees now have water resources management roles beyond the advisory roles. The first schedule of this requires compliance with national values and gender equity requirements made by the constitution. There is still no legal obligation on the part of Water Resources Authority to give any feedback or reasons for taking or rejecting advice of basin area Water Resources Committees. The performance of the new

committees is still left to administrative discretion and no objective evaluation is required. The tenure of the members is still not secured because the Cabinet Secretary (Appointing Authority) is left with the discretion of appointing and revoking appointment at any time.

4.2.4.5 Water Resource Users Associations (WRUAs)

As indicated earlier, Section 5(5) of the Water Act 2002 required WRMA to “formulate a catchment management strategy that encourages the establishment of Water Resources Associations for conflict resolution and cooperative management of water resources in catchment areas” (GoK, 2012). WRUAs were only referred to once in the Water Act 2002. The other provisions relating to formation and registration of WRUAs were contained in the Water Rules of 2006. As observed by Rupert, (2007), the relationship between WRUAs and WRMA as provided for in the legal framework did not assure sustainability in operations of WRUAs.

The water rules defined WRUAs as an association of water users, riparian land owners, or other stakeholders who have formally and voluntarily associated for purposes of cooperatively sharing managing and conserving a common water resource (GoK, 2006). WRUAs provide value addition for sustainability in water utilization and play an instrumental role with regard to approval of permits for abstraction rights on any water resource (Kibugi, 2015). For a WRUA to be considered for registration by WRMA, it had to be legally registered and have a constitution conducive to collaborative management of water resources of a particular resources and which promotes public participation, conflict mitigation, gender main streaming and environmental

sustainability. (GOK, 2006). Section 10(13) of the water rules provided that WRUA registration with the Authority did not confer any legal standing on the WRUA but clarifies which entity is considered by the Authority to be a WRUA for a particular water resource (GOK,2006).

The requirement that WRUAs be registered under other laws and the scope of their wide functions being left to WRMA administrative discretion limited the pace with which they could be established. Their voluntary membership nature also assumed the water users are willing to cooperate in and invest their time and resources in water management activities. It is further observed that despite the WRUA's registering some success in water resource management, their impact is diminished by low public awareness regarding their existence, roles, functions or utility as grass root avenues for public participation (Ibid). The provisions of Water Act 2014 enhances the roles of WRUAs as opposed to their limited scope under the 2002 water Act. It is however important to observe that establishment of WRUAs is still left to the discretion of Water Resources Authority and basin water resource management committees. Further the questions of representation, equity and accountability in the process of establishing WRUAs is not addressed. The challenges to the legal registration of the WRUAs and the assumption that water users will volunteer to be members is still not covered by the Water Act 2016.

Section 10(7) of the Water Rules 2006 provides that "WRMA may enter into a Memorandum of Understanding with a WRUA for the purposes of collaborative management of the water resources". Section 10 (8) further stipulates that "the Memorandum of Understanding may provide for administrative, technical or financial support to the WRUA by the Authority in respect of activities related to collaborative water resource management" (GOK,2006). This

provision put at risk the financial sustainability of the WRUAs since it left the matter to the discretion of WRMA and evasively made it a subject of memoranda.

It is important to observe that even the Water Act 2016 does not address itself to the financial sustainability of WRUAs. The most the Act has done is require the basin area water resource committees to formulate a management strategy that provides systems and guidelines for WRUAs to participate in managing water resources. This still leaves the financial weaknesses of WRUAs unaddressed and creates room for weak management practices at the lowest levels. While the fact of WRUAs being set up outside the Water Act made them fully autonomous, operating beyond any influence of WRMA could make for an awkward relationship between the two. Rupert, (2007) observes that though WRMA cites its duty as providing an enabling environment for the establishment of WRUAs, there exists a risk of using the autonomy of a WRUA to avoid offering any support. A study on WRUAs along Mara River gave an indication that the level of registration and participation by the public in conservation activities in WRUAs was very low. This was attributed to the voluntary nature of the associations, lack of awareness on the existence of WRUAs and the legislations guiding water governance, community participation in water management and use, mandate and membership to WRUAs, and a lack of incentives and huge logistical and financial challenges facing the Water Resource Users Associations (Mwangi ., 2014).

Ongor (2005) observes that several water users Associations have been formed in Kenya. They serve as a mechanism for providing space to people to deliberate on how their local water resources will be managed. These associations are made up of water users who have common

interests such as living near a river, a well or an irrigation scheme (Ibid). From their voluntary nature, the associations are assumed to function without any government funding. An assumption is made that users will naturally cooperate. The power dynamics between and among the members of the WRUA is not addressed anywhere in the policy or legislation. The WRUAs are assumed to be forums for conflict resolution, whereas they have no powers to sanction non-compliance with their resolutions. It is also assumed that the WRUAs will themselves be cohesive and collectively bring forth action in water resource management. This gap is indeed a subject of concern in this study.

Despite the gaps noted above Ongor (2005) observes that community participation in watershed management has been stimulated by the realization by the communities that they are the primary stakeholders in the watersheds where they live. Their participation remains critical strategy in ensuring sustainability of watersheds (ibid). With the foregoing, it is important that mechanisms for stakeholder participation in water resources management be improved as a key strategy of addressing the water resources degradation challenges.

4.3 Factors influencing stakeholders participation

4.3.1: Geographical coverage of WRUAs

As highlighted in earlier, WRUAs are the main mechanism for stakeholders participation applied in implementation of IWRM at the local catchment levels. Their effective establishment and full geographical coverage of the respective river basin is important. The next sections analyze their establishment, representativeness and the factors influencing their effective operations.

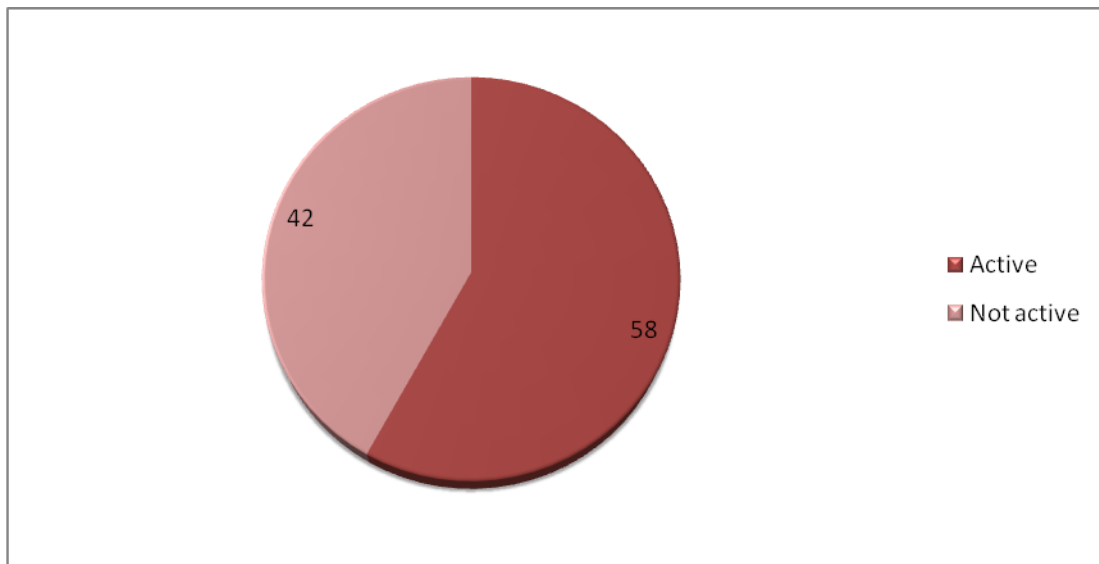


Figure 4. 4: Percentage establishment of WRUAs

There are 18 established and active WRUAs within the upper Athi River basin. These constitute 58% of the proposed total of 30 as shown in Figure 4.4. The non-establishment (activation) of 42% of proposed WRUAs within this part of Athi River basin implies that a large portion of stakeholders do not participate in water resources management. In effect catchment area management plans are not implemented within parts to be covered by the proposed WRUAs.

These areas are therefore prone to degradation and deterioration of water quality. This non establishment of WRUAs in large parts of the basin may be attributed to the gap in the Water Act 2002 that left their establishment to the discretion of WRMA. This gap still persists even with the enactment of the Water Act 2016

4.3.2 Demographic characteristics of WRUAs members

The sample of respondents selected from the establishment WRUAS, composed of 68% male and 32% females as shown in Figure 4.5. This implies that fewer females participate in water resources management. There is need to employ strategies that will enhance the involvement of more women in the activities of WRUAS. This will ensure that all sections of the population participate in water resource management.

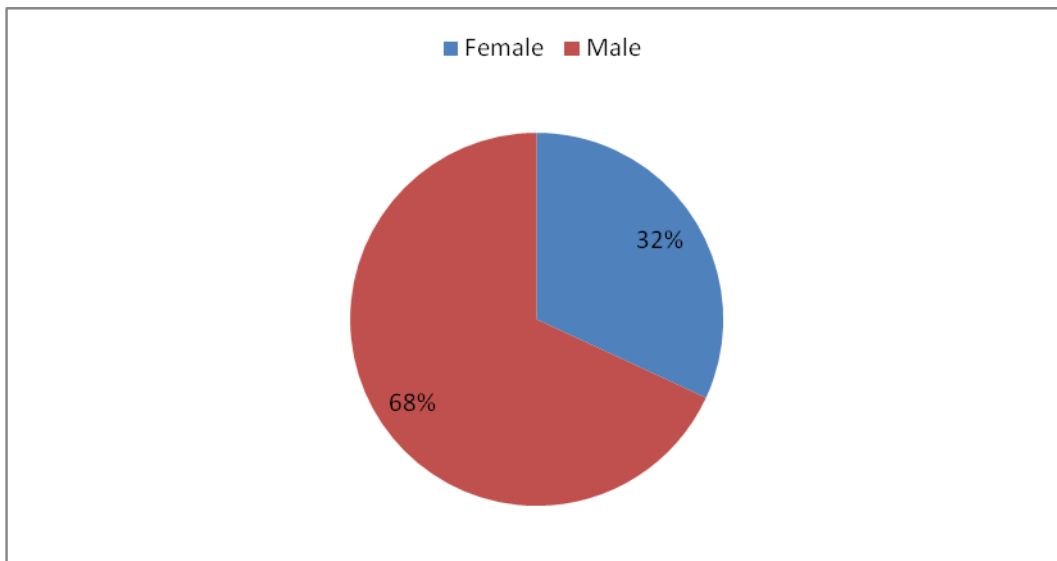


Figure 4. 5: Gender of respondents

The marital status of sampled respondents is presented in Figure 4.6. Those that were married accounted for 90%, 5% single, 3% widowed and 2% divorced. Given this distribution, there is

need to initiate deliberate measures of recruiting more people to enhance representation across marital classes. Most single people are young and the low percentage of single people may point to lesser representation of younger people in society. The voice of younger people would be strengthened if their representation is increased. In addition enlisting younger people will address the gap of succession between the generations. This will ensure that plans and projects initiated will be carried on by the successive generations.

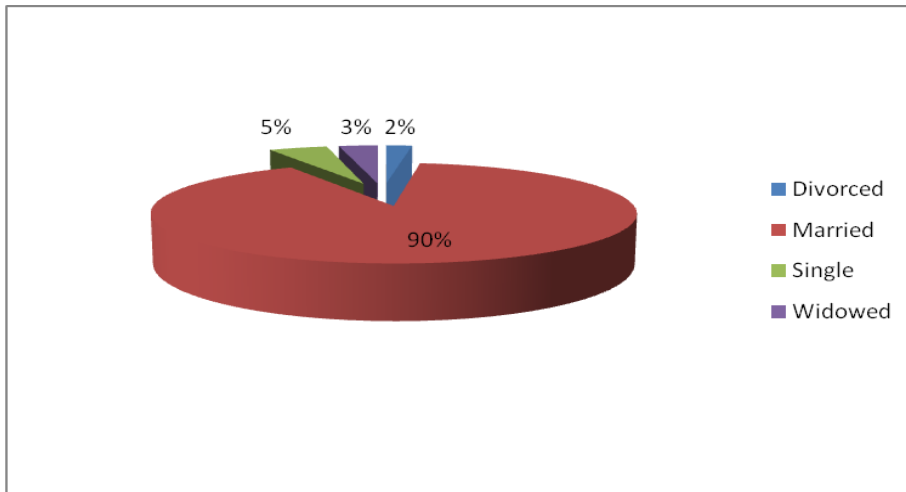


Figure 4. 6: Marital status respondents

The respondent had varying levels of education as shown in Figure 4.7. Those that had attained college education comprise 40%, with 37% having secondary education, 12% have primary education while 11% had received university education. This indicates that a combined 88% of the respondents are above secondary level education and hence have higher capacity to comprehend resource policies. This is a positive indicator to the high potential of the members of the WRUAs in having ability to effectively participate in policy formulation and implementation.

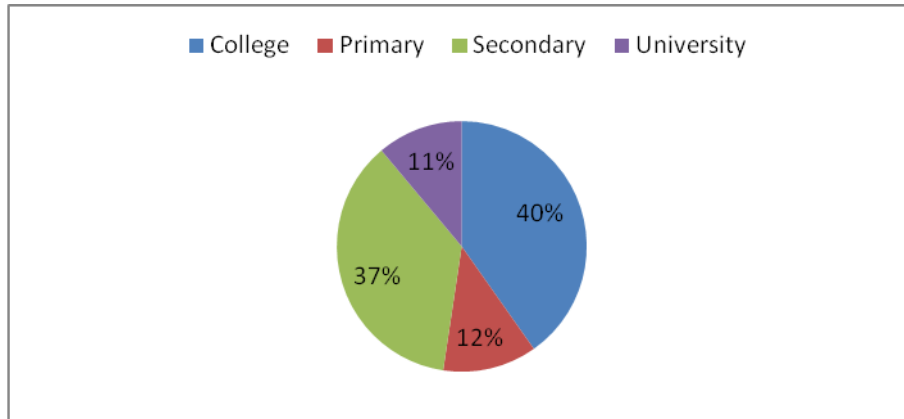


Figure 4. 7: Education levels of respondents

From Figure 4.8 it is shown that 94% of the number of active WRUAS earn between Kshs. 5000 and Kshs.50,000 , with 33% earning Ksh 5,000 and less per month. There is therefore need to device strategies of enrolling more members with higher incomes into WRUAs. The higher the incomes of WRUA members, the higher the capacity they are likely to have in raising resources to finance the water resource management activities.

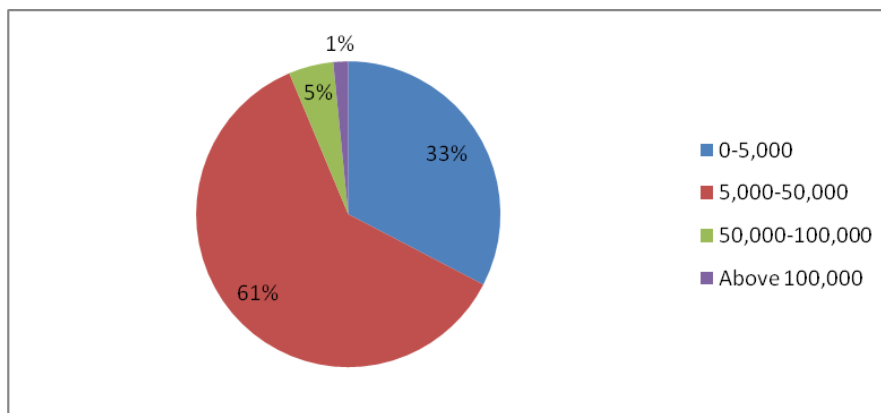


Figure 4. 8: Income of respondents

4.3.3 Process related factors influencing participation in WRUAs

This section discusses the variables that influence the participation of WRUA members in water resource management activities. At the end of the section, a logit regression analysis is used to determine the influence of different the variables.

4.3.3.1 Participation in Preparation and implementation of catchment management plans

Given that catchment area management plans are the key guides for water resource management activities in a catchment area, it was important to examine the participation of respondents in its preparation and implementation. A majority of the respondents (84%) had knowledge of the existence of the Athi River catchment area management plan. However, only 46% were involved in its preparation (Figure 4.9). About 72% of the respondents indicated that they had applied the plan in decision making at the WRUAs level. It is important to ensure involvement of the members of WRUAs in review and formulation of catchment Area Management Plans. This would enhance ownership of management activities by the stakeholders. This will increase their commitment to successful implementation of the management plans.

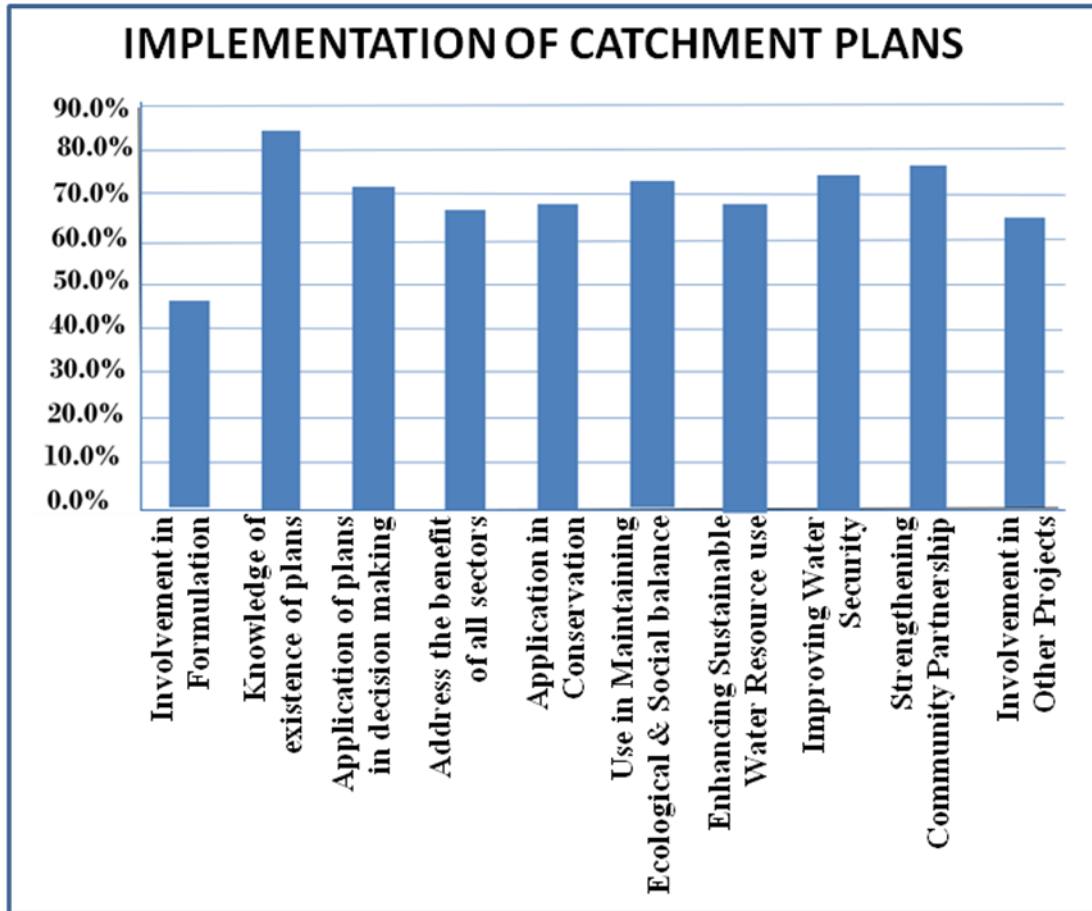


Figure 4. 9: Participation in implementation of catchment management plans (WRUAS activities)

4.3.3.2 Relevance of information relied up by members of WRUAs

For effective participation to occur within WRUAs, the information relied up by the members has to be relevant to water resources management. When asked about the provision of relevant technical and scientific information with WRUAS, 60.5% of the respondents indicated that the information availed was relevant as shown in Figure 4.10 below. It is however worth noting that 39.5% of the respondents indicated that relevant technical and scientific information was not provided.

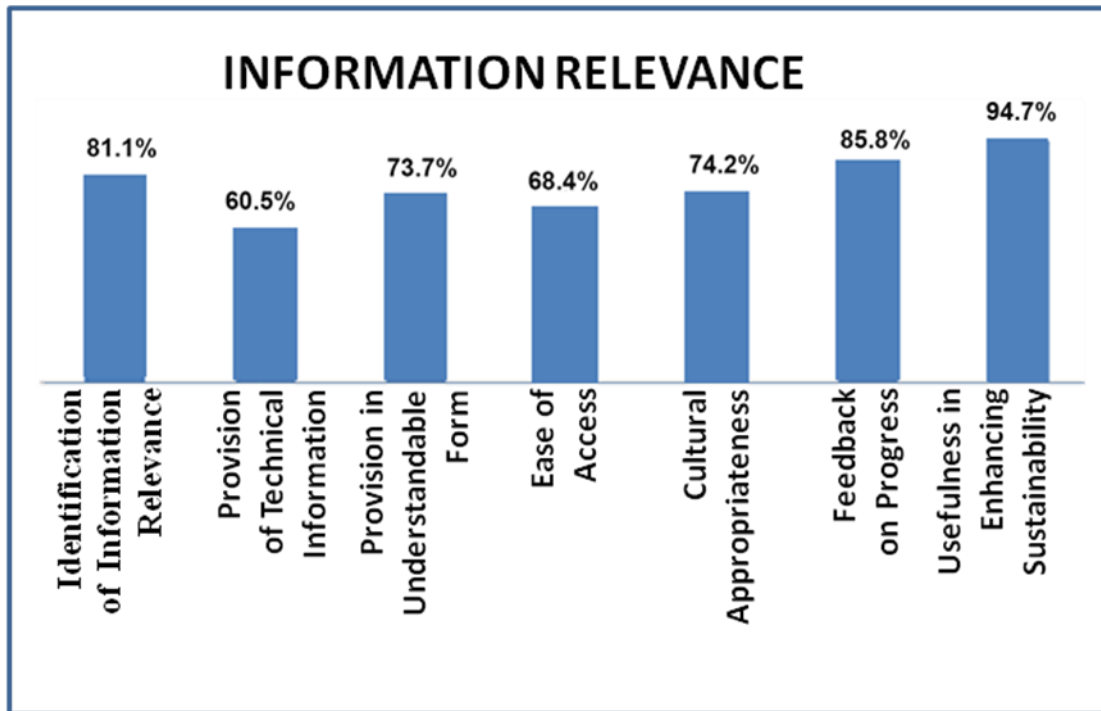


Figure 4. 10: Relevance of information relied upon by members of WRUAS

WRMA would enhance the participation of WRUA members if relevant technical and scientific information was readily provided. A majority (94.7%) of the respondents indicated that this information is useful in ensuring sustainable management of the water resources. Given the significance of giving relevant information to WRUAs in relation to effective participation, it is necessary to ensure that the information is culturally appropriate to address the 25.8% of the respondents who felt that this criterion was not being met.

4.2.3.3 Inclusivity in Management processes

The respondents indicated that there were honest working relationships amongst themselves and with WRMA as per the results presented in Figure 4.11 below. Positive rating was given by 74.2% of the respondents. Freedom to communicate during meetings was positively rated by 87.4%. The inclusivity aspects could however be improved by addressing sensitivity to

stakeholders concerns since 27.9% had indicated that sometimes the WRMA officials were not sensitive to some aspects like language interpretation during meetings.

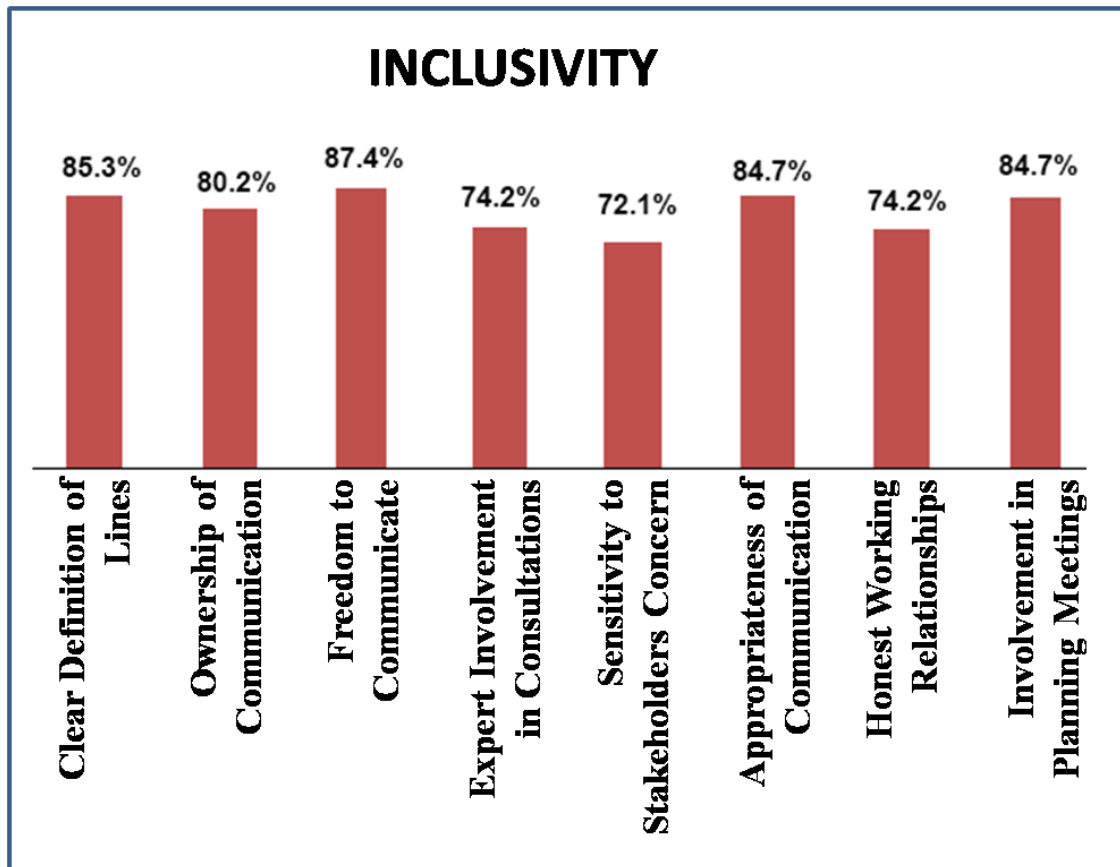


Figure 4. 11: Examining inclusivity

4.3.3.4 Examining Accountability

The various accountability aspects in water management processes were rated differently by the respondents as shown in Figure 4.12. Close to 89% of the respondents indicated that there was good documentation of meeting proceedings; while 75% indicated there were regular updates on progress made in the policy implementation processes. It is significant to observe that 41% of the respondents rated the monitoring and evaluation of catchment area plan implementation process

negatively. There is therefore need to improve the monitoring and evaluation aspects of catchment area management plan implementation process to enhance accountability.

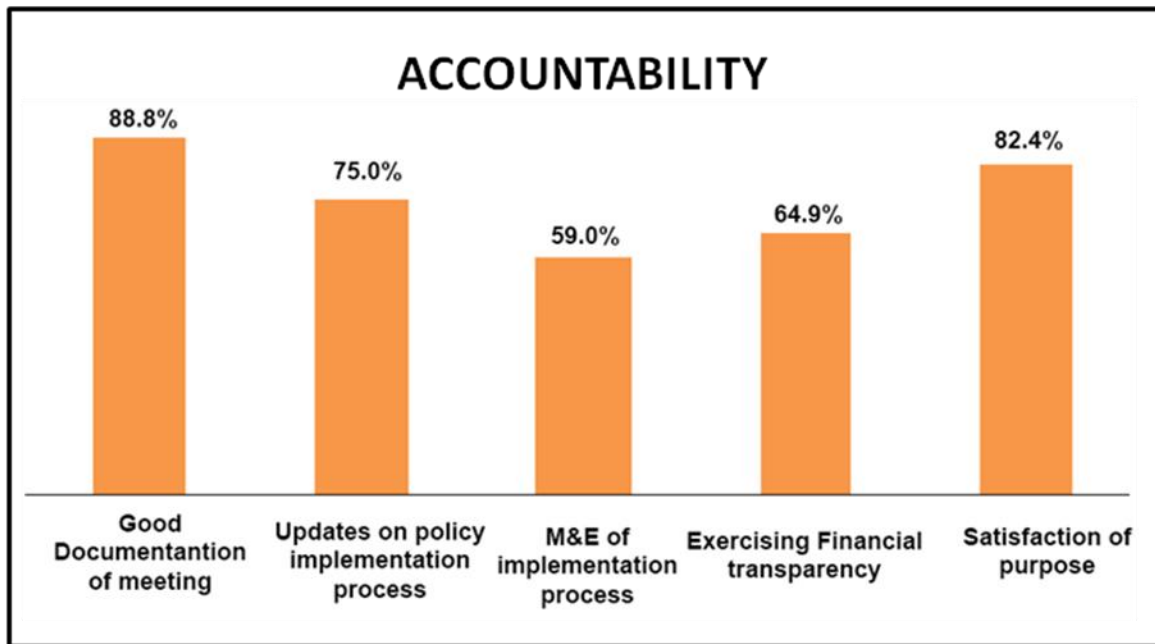


Figure 4. 12: Examining accountability

The respondents who sought improvement in accountability with respect to financial management amounted to 35.1%. This aspect needs improvement to enhance trust within the WRUAs. Clear financial statements should be regularly provided by the leaders of WRUAs and officers in charge of water resource management.

4.3.3.5 Transparency in WRUAs

Respondents rated aspects relating to accountability in conduct of business within WRUAs positively as indicated by results presented in Figure 4.13. Clarity of planning objectives was rated positively by 86.6 % of the respondents while 85.6 viewed the conduct of meetings as open 79.7% indicated that feedback mechanisms existed. An improvement of the notification of changes in plans is necessary to improve transparency given that 31.6% rated this aspect

negatively. Openness of the budget process was also indicted by 30.5 %. It is therefore important for the water resource managers and the WRUA leaders to improve on these on these aspects in order to enhance transparency. This will increase the confidence of both the stakeholders and potential partners that there is good stewardship of the WRUAs. As a result, this is likely to translate into increased cooperation in the water resource management activities.

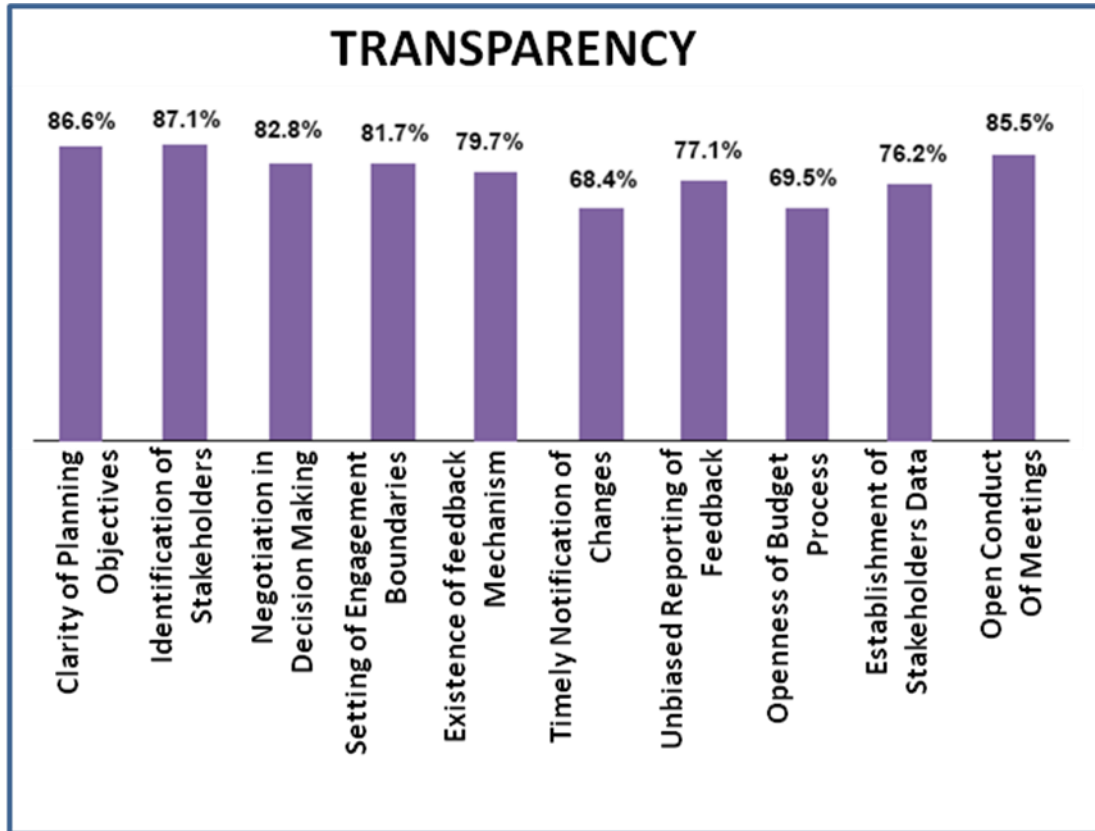


Figure 4. 13: Transparency in WRUAs

4.2.3.6 Access to information

Information delivery timeframes in the water resource management activities within upper Athi river basin by WRMA received positive rating by 68% of the respondents as shown in Figure 4.14. It is therefore necessary to improve these aspects to enhance participation. About 62% of

the respondents indicated that response time given provided was sufficient, 60% indicated that information was availed throughout the engagement cycle. The 40% that retained a negative rating point at the need to keep information flowing throughout the management cycle. When asked whether their views were sought early enough 70% replied in the affirmative. It is important improve this aspect to ensure that inputs from the stakeholders are incorporated in management plans.

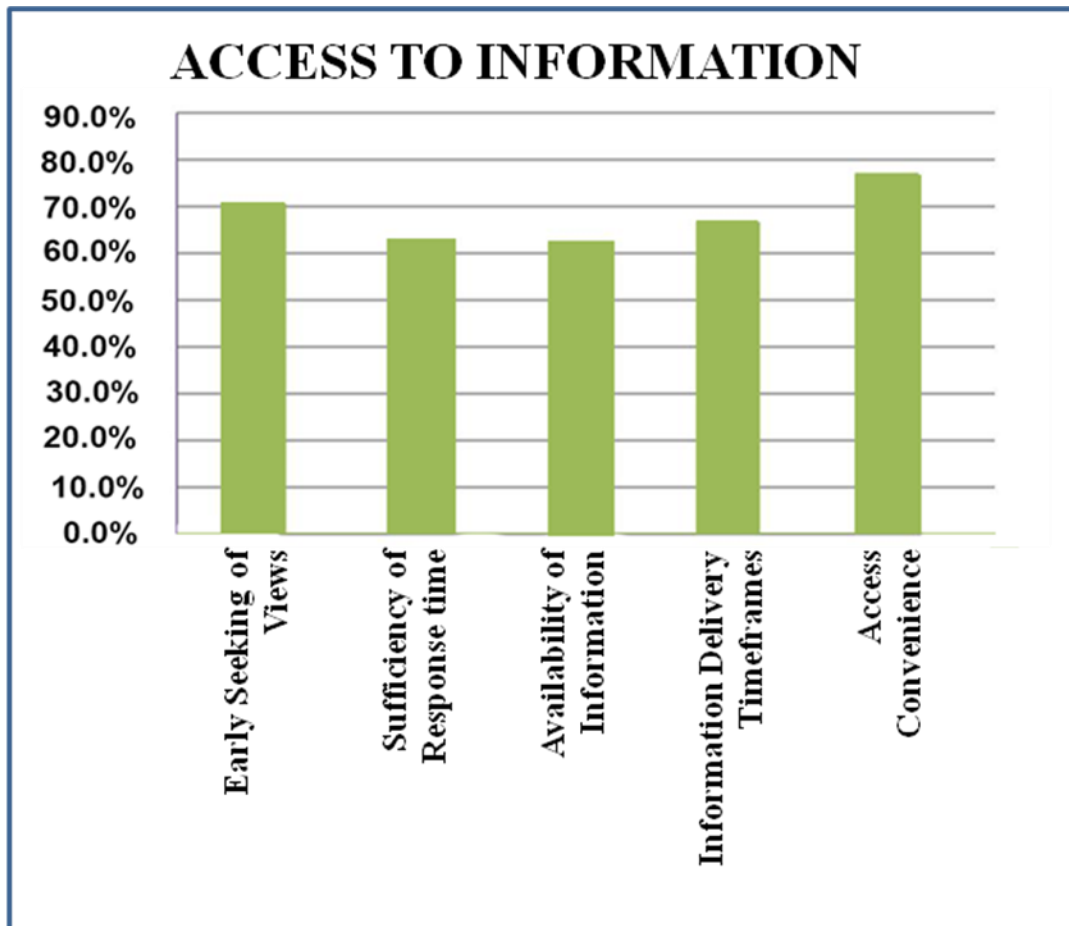


Figure 4. 14: Access to information in water resource management activities.

4.3.3.7 Influence of WRUAs

Increased influence by WRUAs arising from cooperation between government and WRUAs was reported by 78.2% of the respondents as per the results presented in Figure 4.15 above. Involvement in WRUAs has resulted in ownership of outcomes by all. Fostering of teamwork within WRUAs has enhanced their influence in water resources management according to 91% of the respondents. It is therefore evident that the WRUAs are effective platforms for stakeholder participation in water resource management.

Given the large positive rating recorded for the various participation attributes by respondents, it is clear that WRUAs are useful platforms for water resources management. It is therefore important that their establishment is fast tracked to cover the entire geographical area of the Upper Athi River basin for full benefits of public participation in water resource management to be realized, is also necessary.

Improvement of the various gaps noted in relation to provision of relevant information, inclusivity and accountability.

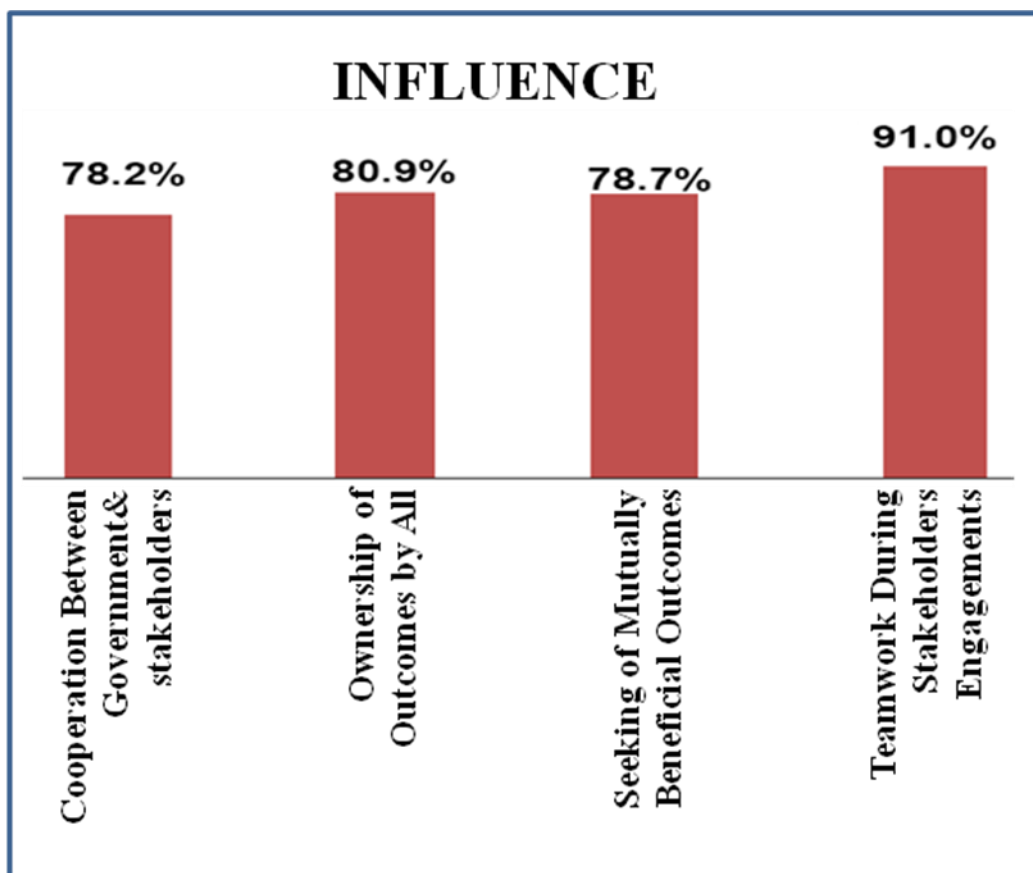


Figure 4. 15: Assessment of influence of WRUAs

4.3.3.8: Regression Analysis Results

From the different factors influencing participation, a variable ‘participation’ was constructed. It had a value of 1 for participation and 0, otherwise. We regressed this variable against independent variables viewed to have an association with active participation of stakeholders in water resource management. Literature review and preliminary factor analysis in the foregoing sections was used to categorize variables into representation; accountability; inclusivity; information relevance; access to information; education level; marital status and income. Logit regression analysis resulted in the model presented under Table 4.1 below.

Provision of technical and scientific information in a manner that can be understood and in modes that ease access is key. Due regard to cultural appropriates is also be important in enhancing the participation of stakeholders in water resource management.

The negative relationship between participation and the number of years in education should also be addressed. It would be important to seek strategies that motivate stakeholders with higher levels of education to robustly take part in water resources management at the WRUA's level. The planning of WRUA's activities should be designed to incorporate stakeholders of all income levels and specifically address challenges that may deter active participation of those with very low incomes or very high income.

4.4 Stakeholders responses to policy interventions

Under this section, the results of responses by industrialists, farmers and residential stakeholders to government (policy) changes on levels of fines, waste disposal licenses and incentives for abatement of degradation are presented and discussed. The responses are used to play iterative prisoner's dilemma games with scores assigned on the basis of strategic options for each stakeholder or the government. It is assumed that the stakeholders are rational and pursue the objective of maximizing economic interests and minimizing costs. The government seeks to maximize social and environmental benefits (abate degradation) while minimizing its costs.

4.4.1 Government strategic options

Table 4.2 below presents the strategic options for the government and the possible payoffs. The payoffs are assigned ordinal values for purposes of analyzing preferences of players in the prisoners' dilemma game. Under option (A), the government attains maximum score (payoff) if degradation ceases to take place without it taking any policy or enforcement action. This in effect means that high quality of water in Athi River basin is achieved without any cost to the government and therefore its gain is maximum and cost is zero.

Table 4. 2: Government Strategic options and respective payoffs

Option	Action	Payoffs	Abbrev.	Rank
A	Government chooses not to effect policy measure to STOP degradation while users choose to STOP degradation.	30	CS	Best
B	Government effects policy measure to STOP degradation while users choose to conserve	20	SS	2 nd Best
C	Government chooses not to effect policy measure to abate degradation while Users chooses to CONTINUE with Degradation	10	CC	Least
D	Government effects policy measure to STOP degradation while users CONTINUE with degradation	0	SC	Worst

Under option B the government attains the second best score if users stop degradation following the government move to effect a policy measure (fine, license charge or incentive) that result in the users choosing to stop degradation and hence resulting in high water quality. Under this option the government incurs costs of policy intervention and achieves its objective of abating degradation. Option C is the government's third ranking score since it chooses not to make any policy intervention (fine, license charge or incentive) and the users continue with degradation (loss of water quality). It therefore incurs no costs but gets no benefits (degradation abatement). Option D is the government's worst option and it scores least since it makes policy intervention (Fine, License charge, incentive) yet the users choose to continue with degradation. This implies that cost of the intervention is incurred yet the losses associated with degradation (water quality loss) persist.

4.4.2 Stakeholders (Users) strategic options

Table 4.3 shows the users' (Industrialist, Farmers, and Residential users) strategic options and attendant payoffs. The best option for stakeholders (users) is a situation where they continue to cause degradation while the government assumes the cost of abating degradation.

Table 4. 3: Stakeholders Strategic options and respective payoffs

Option	Action	Payoffs	Abbrev.	Rank
A	Users choose to CONTINUE degradation while government effects policy measure to STOP degradation	30	CS	Best
B	Users choose to STOP degradation while the government effects policy measure to STOP degradation	20	SS	2 nd Best
C	Users chooses to CONTINUE with degradation while the government effects NO policy measure to abate degradation	10	CC	Least
D	Users choose to STOP degradation while government chooses to effect NO policy measure to abate degradation	0	SC	Worst

The second best option is where the stakeholders (users) choose to stop degradation and the government chooses to carry the costs of policy intervention to abate degradation. The third best option is where the stakeholders continue with degradation and accrue benefits and the government does not put in place any policy intervention for degradation abatement. The worst option for stakeholders is to stop degradation and thus get no benefits yet the government puts no policy measures to abate degradation. They therefore loose the opportunity to continue without a cost.

Table 4.4 below summarizes how the strategic options of both stakeholders and government would appear in an iterative prisoner’s dilemma game.

Table 4. 4: Repeated Prisoner’s Dilemma Matrix with payoffs for strategic options

		Stakeholders (Users)			
		Stop		Continue	
Government	Stop	20	20	0	30
	Continue	30	0	10	10

With this model the next sections present a discussion of the actual responses and resultant game payoffs for each of the policy interventions.

4.4.3 Stakeholders responses to fines at various levels

From literature review it was evident that the government has adopted the use of fines as a measure of abating degradation. The levels of fines are set out under the EMCA Act 1999. The study sought to establish the responses of the various users’ changes in the levels of fines. The responses for the various categories of users are analyzed below.

4.4.3.1 Industrialists responses to changes in levels of fines

When the levels are adjusted upwards to the range of Ksh 500,000 to 999,000 those insisting on continued degradation reduce to 62% (Table 4.5). With further rise of fines to between Ksh 1,000,000 and Ksh 4,999,000 those choosing to engage in degradation significantly drop to 19%.

Additional increases in fines further reduce those willing to continue with degradation to 14% while fines above Ksh 10,000,000 result in 100% willing to stop degradation. The highest number of industrialists would cease from activities causing degradation if the levels are increased to between Ksh 1,000,000 and Ksh 4,999,000.

Further increases to the range of Ksh 5,000,000 to 9,999,000 yield only a marginal increase in those abating degradation. With these responses repeated prisoners dilemma game were played on basis of payoffs assigned from strategic industrialists (users) and government (policy maker) cited in Tables 4.2 and 4.3 earlier.

Table 4. 5: Industrialist responses to changes in levels of fines

Fines (Ksh.)Level (Ksh)	Continue (No.)	Percentage (%)	Stop (No.)	Percentage (%)
100,000 – 499,000	17	81	4	19
500,000 - 999,000	13	62	8	38
1,000,000 – 4,999,000	4	19	17	81
5,000,000 – 9,999,000	3	14	18	86
Above 10,000,000	0	0	21	100

The average results of the scores at each level are as presented in table 4.6 below.

Table 4. 6: Payoffs for games played using industrialist responses to different levels of fines

Fines Level	Payoffs	
	Continue	Stop
100,000 – 499,000	12.8	11.6
500,000 – 999,000	15.2	12.8
1,000,000 – 4,999,000	16.8	15.6
5,000,000 – 9,999,000	14.0	20.0
Above 10,000,000	0.0	30.0
Cumulative Payoffs	58.8	90.0
Average Score	11.76	18.0

From the results presented on Table 4.6 above, it is evident that fines are yielding an average payoffs (score) of 18 for the government which is higher than 11.76 score for industrialists. This mean that fines can be an effective tool for government to use in abating degradation. The scores from the games are graphically presented in fig 4.16 below to display the utility functions of both the industrialist (user) and government with respect to changing levels of fines.

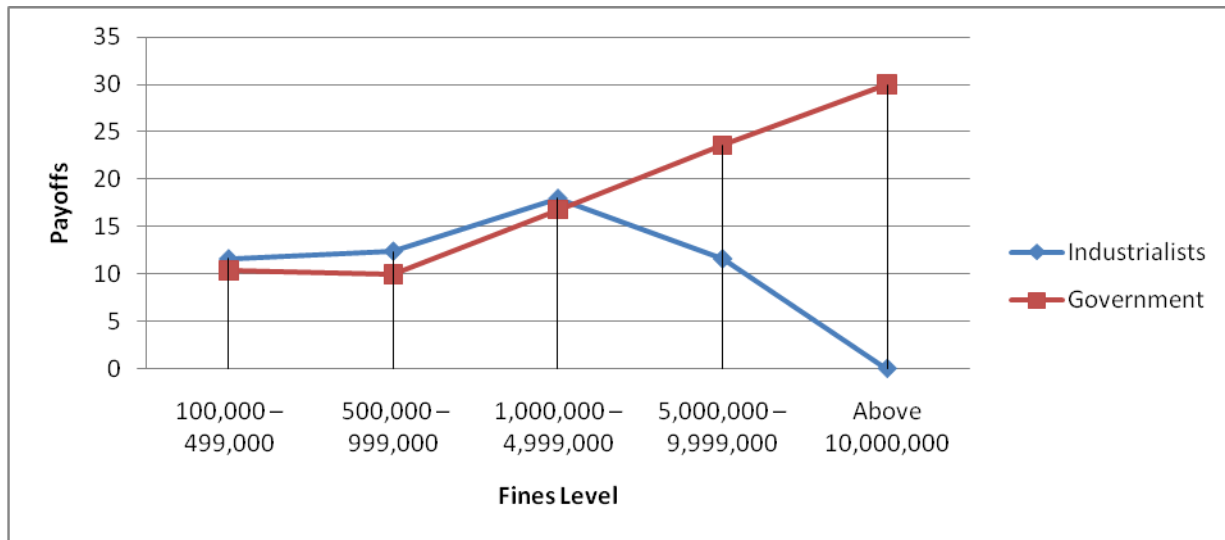


Figure 4. 16: Utility functions for industrialists and government based on payoffs at different levels of fines

Fines ranging from Ksh 1,000,000 to 4,999,000 tend to the equilibrium where the payoffs for the industrialists and those of the government are almost even and therefore this would be the optimal sustainable level. Fine levels from 5 million tend to benefit only government and would frustrate the economic objective of the industrialists. They yield zero payoffs for the industrialist and represent the worst option in terms of industrial interests.

4.4.3.2 Farmers responses to changes in levels of fines

From Table 4.7, 29% of farmers will continue with degradation at fines levels of Ksh 100,000 – Kshs 499,000. The percentage doesn't change even if the levels are increased to between Ksh 500,000 and 999,000. This implies that at the increased level of tax, the government doesn't benefit much in terms of achieving abatement of degradation. There is decrease of those continuing with degradation to 25% when the fine levels are shifted to between Ksh 1,000,000

and Ksh 4,999,000. At fines between Ksh 5,000,000 and Kshs 9,999,000, ninety six percent of the farmers stop activities that cause degradation. At fines above Ksh 10,000,000 no one is willing to engage in activities that cause degradation. From these results it is evident that more farmers are willing to abate degradation at lower levels of fines as compared to industrialists. Fines above Ksh 5 million appear to yield high losses for the farmers and most of them opt to stop degradation.

Table 4. 7: Farmers response to changes in levels of fine

Fines (Ksh.)	Continue (No.)	Percentage (%)	Stop (No.)	Percentage (%)
100,000 – 499,000	14	29	34	71
500,000 - 999,000	14	29	34	71
1,000,000 – 4,999,000	12	25	36	75
5,000,000 – 9,999,000	2	4	46	96
Above 10,000,000	0	0	48	100

Using the responses obtained from farmers repeated prisoners dilemma, games were played with payoffs assigned to strategic options. The results of these games are presented in Table 4.8.

Table 4. 8: Resultant payoffs from games played using farmers responses to different levels of fines

Fines Level	Payoffs	
	Continue	Stop
100,000 – 499,000	18.0	16.8
500,000 – 999,000	19.6	17.2
1,000,000 – 4,999,000	20.0	18.8
5,000,000 – 9,999,000	11.6	23.6
Above 10,000,000	0	30
Cumulative Payoffs	69.20	106.4
Average Score	13.84	21.28

When government applies fines to farmers as a policy measure to abate degradation it receives an average payoff (Score) of 21.25%, while farmers have an average score of 13.84. Fines can therefore be an effective measure of averting degradation caused by farmers in upper Athi River Basin. The scores for repeated prisoners dilemma games played between farmers and the government are presented graphically under Figure 4.17 below.

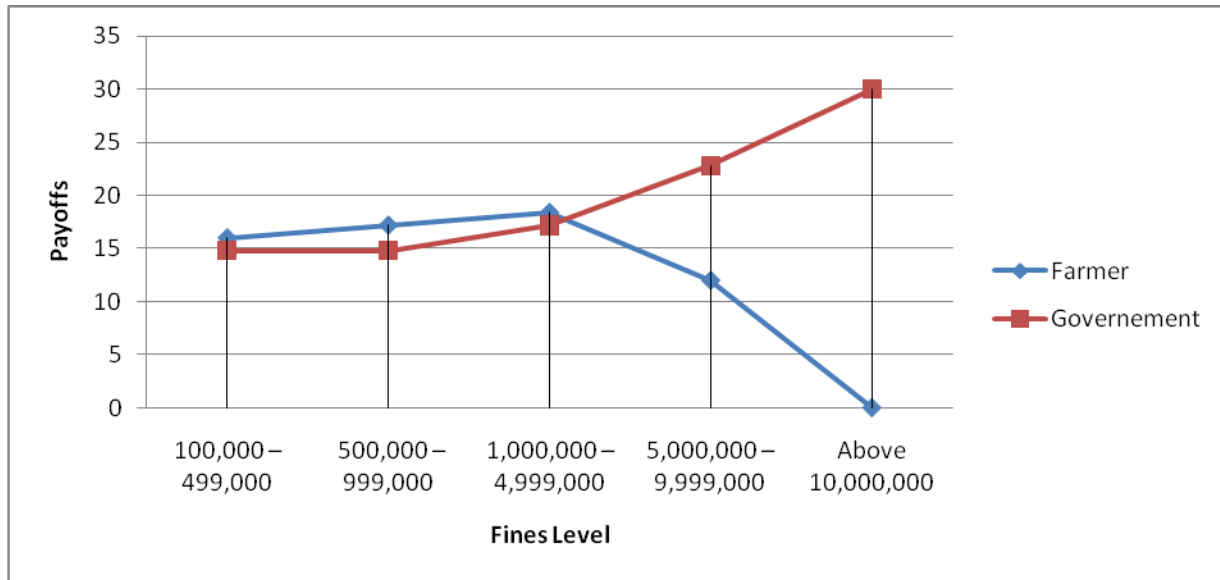


Figure 4. 17: Utility functions for farmers and government based on payoffs at different levels of fines.

The equilibrium of the resultant utility functions of the government and the farmers in upper Athi River basin fall within the fines range of Ksh 1,000,000 and 4,999,000. The range would keep most farmers pursuing their economic activities while the government will keep enforcing fines with positive results. Fines in the range of 5,000,000 to 9,999,000 will yield low utility (benefit) for the farmers and those above 10,000,000 push them completely out of economic engagement and therefore will not present an optimal scenario. It is worth noting that the variance between the government and farmers payoffs even at the lower levels of fines is minimal and therefore fines would be a highly effective measure for abating degradation emanating from farming activities in the basin.

4.4.3.3 Residential Users responses to changes in levels of fines

The results shown in Table 4.9 indicate that 21% of the residential users are to continue with degradation if fine levels are to be applied at the range of Ksh 100,000 to Ksh 499,000. This is a relatively low percentage compared to that of industrialists and farmers.

Table 4. 9: Residential users’ responses to changes in levels of fines

Fines (Ksh)	Continue (No.)	Percentage (%)	Stop (No.)	Percentage (%)
100,000 – 499,000	26	21	95	79
500,000 - 999,000	16	13	105	87
1,000,000 – 4,999,000	3	2	118	98
5,000,000 – 9,999,000	1	0.01	120	99.99
Above 10,000,000	0	0	121	100

Only 13% is set to continue with activities that cause degradation if the fine levels are increased to between Ksh 500,000 and Ksh 999,000. Two percent would engage in degradation if fines are between Ksh 1,000,000 and Ksh 4,999,000. At fines level between ksh 5,000,000 and Kshs 9,999,000 less than 1 % is going to engage in degradation. None would engage in degradation if fines were above Ksh 10,000,000. Significant cooperation is attained by government effecting fines at levels below Ksh 1,000,000. It is evident that the losses for residential users engaging in degradation would accelerate at fine levels above Kshs 1,000,000. Using these responses to play repeated prisoners dilemma game between residential users and the government, the summary scores presented in Table 4.10 below are obtained.

Table 4. 10: Resultant payoffs from games played using residential users’ responses to different levels of fines

Fines Level	Payoffs	
	Continue	Stop
100,000 – 499,000	18.4	17.2
500,000 – 999,000	19.6	17.2
1,000,000 – 4,999,000	19.6	18.4
5,000,000 – 9,999,000	12.0	22.8
Above 10,000,000	0	30
Cumulative Payoffs	69.60	105.6
Average Payoff	13.92	21.12

The average payoffs for government application of fines to residential users in stopping degradation stand at 21.12 whilst the moves of residential users at the various levels give an average score of 13.92. This implies that application of fines by government as a policy measure to avert degradation would be effective since it results in higher benefits (gains). Under Figure 4.17 the payoffs from the repeated prisoners’ dilemma games are presented in graphical form displaying the utility functions of the government and residential users at the various levels of fines. Equilibrium (the point where the two functions meet) is attained when the fine levels are at the range of Ksh 1,000,000 to Ksh 4,999,000. This would there be the optimal level where the government measures to impose fines to residential users is effective and does not frustrate the economic interests of the residential users.

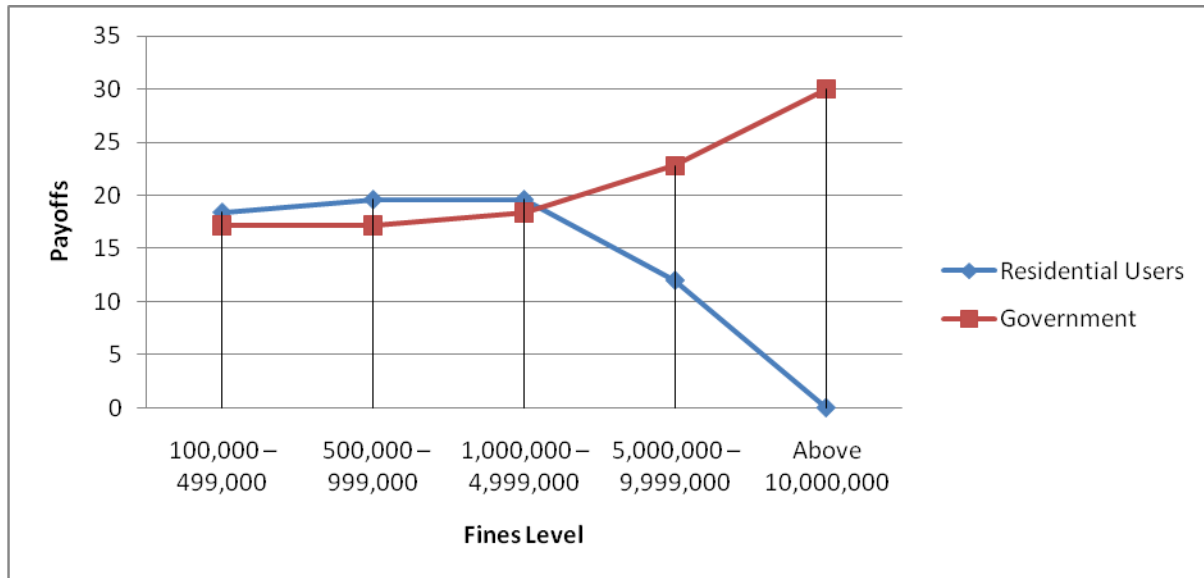


Figure 4.18: Utility functions for residential users and government based on payoffs at different levels of fines

4.4.4 Stakeholders (Users) responses to changes in levels of waste disposal license charges

The government has been applying a policy measure of issuing waste disposal licenses to various stakeholders (users). Responses obtained from the stakeholders in upper Athi River basin with respect to changing levels of charges are presented and discussed below.

4.4.4.1 Responses to changes in levels of waste disposal licenses

Industrialists' responses to changes in levels of waste disposal license charges by the government are presented in Table 4.11.

Table 4. 11: Industrialists responses to changes in levels of waste disposal license charges

License (Ksh)	Continue (No.)	Percentage (%)	Stop (No.)	Percentage (%)
100,000 – 499,000	19	90	2	10
500,000 – 999,000	19	90	2	10
1,000,000 – 4,999,000	11	52	10	48
5,000,000 – 9,999,000	8	38	13	62
Above 10,000,000	2	0	21	100

If the waste disposal license charges are at the level of Ksh 100,000 to Ksh 499,000; ninety percent of the industrialists would continue to engage in activities that cause degradation. This situation doesn't change even with the increases of license charges to the range of Ksh 500,000 to Ksh 999,000. The number of those willing to continue engaging in degradation however reduces to 52% of the industrialists at the license change levels of Ksh 1,000,000 to Ksh 4,999,000. There is a further reduction to 38% when the license charges are hiked to between Ksh 5,000,000 and Ksh 9,999,000. No industry was willing to engage in degradation if the license changes were pegged at levels above Ksh 10,000,000. It is therefore evident that waste license change levels below one million would yield no benefits to the government but serve the selfish interests of industries engaging in activities that cause degradation of the basin. Applying the results of the industrialist responses to changing levels of waste disposal license charges in playing repeated prisoners dilemma games produces payoffs as presented in Table 4.12 below:

Table 4.12: Resultant payoffs from games played using Industrialist responses to different levels of waste disposal license charges

License Level	Payoffs	
	Industrialists	Government
100,000 – 499,000	11.6	10.4
500,000 – 999,000	12.4	10.0
1,000,000 – 4,999,000	15.6	14.4
5,000,000 – 9,999,000	12.0	18.0
Above 10,000,000	0	30
Cumulative Payoffs	51.6	82.8
Average Score	10.32	16.56

The average scores for the government are 16.56 as compared to 10.32 of industries. This indicates that disposal licenses can be used as an intervention to avert degradation by the government. The payoffs indicate the optimal level of waste disposal license charges for industries would fall in the range of Ksh 1,000,000 to Ksh 4,999,000. The graphical presentation of the payoffs under figure 4.19 give a pointer to the losses of industrialist users being greater if waste disposal license charges are above Ksh 10,000,000. The equilibrium (optimal level) appears to take place when the license charge level is between 1,000,000 and Ksh 4,999,000. That is when the utility functions of the government intersect with that of the industrial.

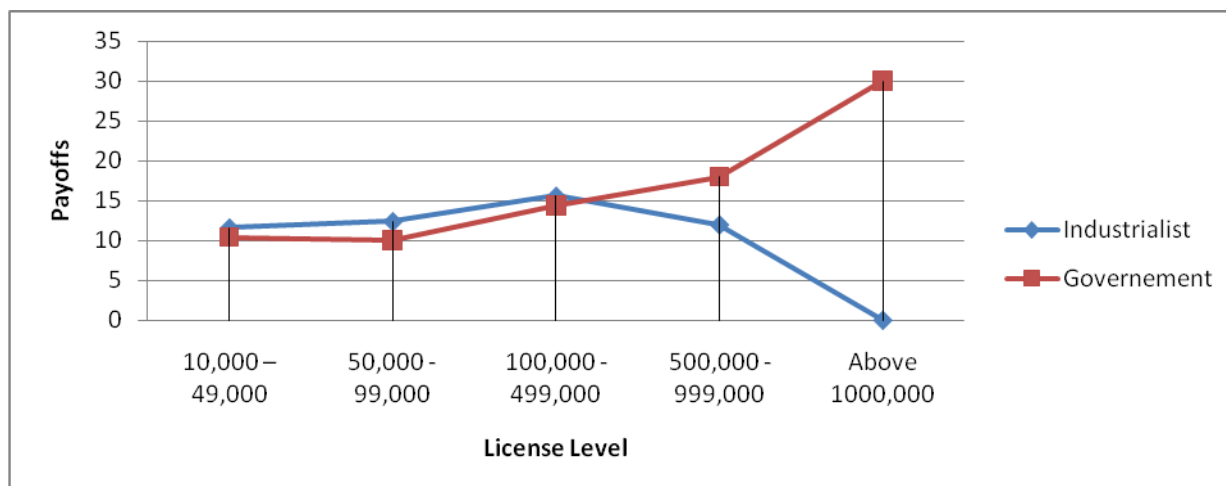


Figure 4.19: Utility functions for industrialists and government based on payoffs at different levels of waste disposal license charges

4.4.4.2 Farmers Responses to changes in level of waste disposal license charges.

The results of farmers’ responses to changing levels of license charges are shown in Table 4.13.

Table 4. 13: Farmers Response to charges in levels in levels of waste disposal license charges

License (Ksh.)	Continue (No.)	Percentage (%)	Stop (No.)	Percentage (%)
10,000 – 20,000	24	50	24	50
21,000 - 50,000	19	40	29	60
51,000 – 100,000	13	27	35	73
101,000 – 500,000	5	10	4	90
Above 500,000	0	0	48	100

When government fixes the levels of waste disposal license at the level between Ksh 10,000 to Ksh 20,000, 50% of the farmers would continue with degradation. By a shift of the levels to between ksh 21,000 and Ksh 50,000 this proportion reduces to 40%. If the license levels are increased to the range of Ksh 51,000 and Ksh 100,000 the farmers opting to continue with degradation reduce to 27%. At levels between 101,000 and Ksh 500,000 only 10% of farmers are willing to continue with degradation. Charges beyond Ksh 500,000 no farmer is willing to engage in degradation. This implies that degradation becomes too costly to farmers. Using these responses to play a repeated prisoners dilemma game between farmers and the government yields the results displayed in Table 4.14.

Table 4. 14: Resultant payoffs from games played using responses to different levels of waste disposal license charges

License Level	Payoffs	
	Farmer	Government
10,000 – 20,000	15.6	14.4
21,000 – 50,000	17.6	15.2
51,000 – 100,000	18.0	16.8
101,000 – 500,000	14.0	21.2
Above 500,000	0	30
Cumulative Payoffs	65.2	97.6
Average	13.04	19.52

The average government payoffs at all the levels of licenses charges applied to farmers yields a payoffs of 19.52 compared to that of 13.04 accruing to farmers. Waste disposal licenses applied

at the appropriate levels would therefore be an effective tool for the government to control degradation emanating from farming activities within the upper Athi River basin. The graphical plot of the resultant game payoffs and the attendant utility functions for farmers and the government is as presented in Figure 4.20.

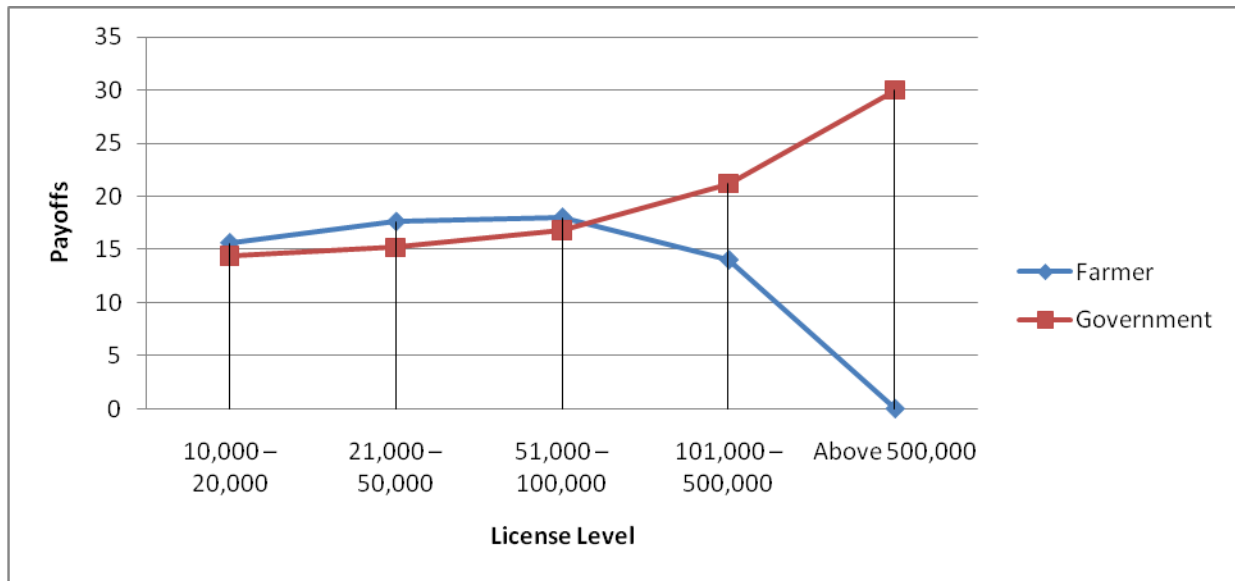


Figure 4. 20: Utility functions for farmers and government based on payoffs at different levels of waste disposal license charges

The equilibrium lies in the range of Ksh 51,000 and Ksh 100,000. It represents the optimal level (intersection of the functions) that will have degradation controlled without frustrating farming interests. The farmers cooperate in abating degradation while the government’s measure does not frustrate their economic interests. The government measures are effective and yield optimal results in abating degradation.

4.4.4.3 Residential user’s responses to changes in levels of waste disposal license charges.

The government action to change levels of waste disposal license changes would yield responses presented in Table 4.15.

Table 4. 15: Residential users Responses to changes in levels of waste disposal license charges

License (Ksh)	Continue (No.)	Percentage (%)	Stop (No.)	Percentage (%)
10,000 – 20,000	44	36	77	64
21,000 - 50,000	24	20	97	80
51,000 – 100,000	20	17	101	83
101,000 – 500,000	7	6	114	94
Above 500,000	0	0	121	100

At the level of Ksh 10,000 – Ksh 20,000, 36% of residential users indicated that they would continue with degradation. With the increase of license charges to between Ksh 21,000 and Ksh 50,000 the proportion keen on continuing with degradation drops to 20%. A further increase to the range of Ksh 51,000 to Ksh 100,000 results in 17% of residential uses insisting on continuing with degradation. Pitching the license charges at the level of Ksh 101,000 to Ksh 500,000 results in only 6% of the residential user respondents seeking to continue with degradation activities. At levels above Ksh 500,000 no residential users gave indications of seeking to proceed with degradation. The responses presented in table 14 were used to play repeated prisoners dilemma games between the residential users and the government with emerging outcomes being as presented in Table 4.16.

Table 4. 16: Residential users’ responses to different levels of waste disposal license charges

License Level	Payoffs	
	Residential Users	Government
10,000 – 20,000	17.2	16.0
21,000 – 50,000	19.6	17.2
51,000 – 100,000	19.2	18.0
101,000 – 500,000	11.6	23.6
Above 500,000	0	30
Cumulative Payoffs	67.6	104.8
Average	13.52	20.96

The average government score (payoff) in 20.96 while that of the residential users is 13.52. This implies that appropriate application of waste disposal license charges can be an effective to for government to apply in abating degradation. Plotting payoffs accruing to the government and the residential users result in utility functions is presented in Figure 4.21.

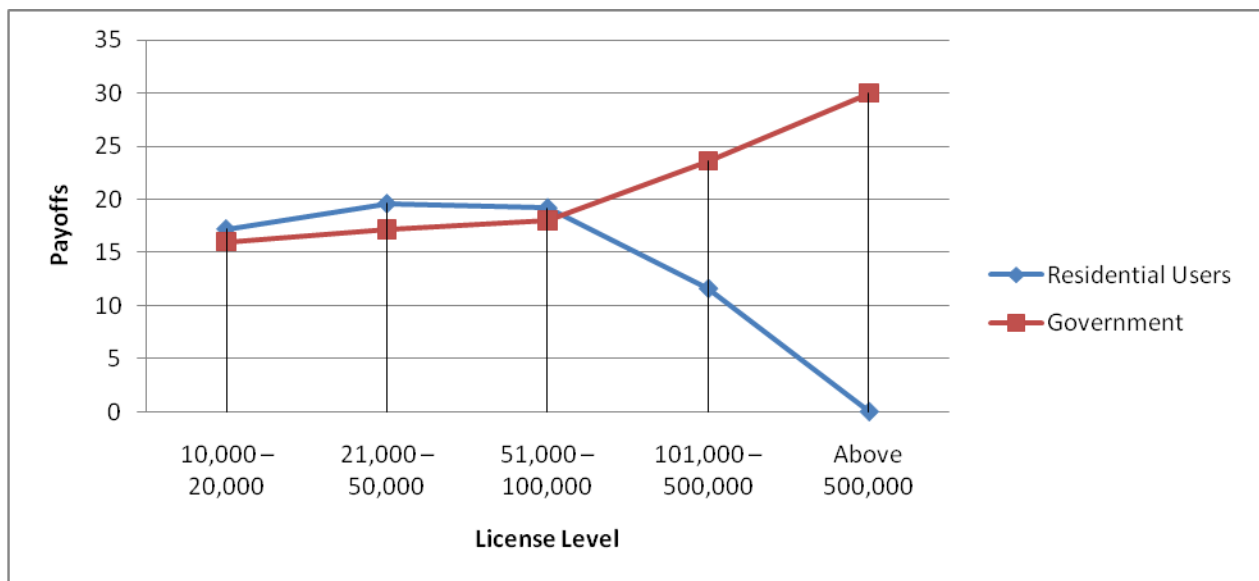


Figure 4. 21: Utility functions for residential users and government based on payoffs at different levels of waste disposal license charges

The equilibrium (optimal level) license level between the residential users and the government falls within the range of Ksh 51,000 to Ksh 100,000 where gains (payoffs) of the two are almost evening out and the utility functions are intersecting. Beyond this range the residential users start registering increased losses while the government registers immense gains (payoffs)

4.4.5 Response to government incentives to abate degradation

Besides use of fines and licenses the government may choose to offer incentives to those who invest or adopt in measures that stop degradation. In this section the responses of various users to likely levels of incentives are presented and discussed.

4.4.5.1 Industrialists responses to various levels of incentives offered by the government

With government offering incentives to industries to abate degradation at different value ranges the industrial users interviewed in upper Athi River basin responded in the manner presented in Table 4.17.

Table 4.17: Industrialists responses to changes to charges in levels of incentives

Incentives (Ksh)	Continue (No.)	Percentage (%)	Stop (No.)	Percentage (%)
100,000 – 499,000	19	90	2	10
500,000 – 999,000	19	90	2	10
1,000,000 – 4,999,000	6	29	15	71
5,000,000 – 9,999,000	1	5	20	95
Above 10,000,000	0	0	21	100

If the government offered incentives of between Ksh 100,000 and Ksh 499,000, ninety percent of the industries will not be motivated to cease degradation. Increase of the incentives to the range of Ksh 500,000 to Kshs 999,000 will not yield any different results. Shifting the incentives upwards to between Kshs 1,000,000 and Ksh 4,999,000 results in a significant change with only 29% indicating that they would continue with degradation. Taking the incentives to the level of Kshs 5,000,000 to Ksh 9,999,000 would leave only 5% not motivated to abandon degradation. At incentives of above Ksh 10,000,000 all the industrial respondents indicated that they would cease to engage in any activity that results in degradation. The implication at this level is that the opportunity cost of not accepting the incentive is too high for any of the industries. Using the responses to play repeated prisoners dilemma games between the government and industrial users yields the payoffs results presented in Table 4.18.

Table 4. 18: Resultant payoffs from games played using industrialists’ responses to different levels of incentives

Incentives Level	Payoffs	
	Industrialists	Government
100,000 – 499,000	11.6	10.4
500,000 – 999,000	12.4	10.0
1,000,000 – 4,999,000	18.0	16.8
5,000,000 – 9,999,000	11.6	23.6
Above 10,000,000	0	30
Cumulative Payoffs	53.6	90.8
Average Score	10.72	18.16

The resultant average payoffs for the government are 18.16 while those of the industrial users are 10.72. This implies that use of incentives by the government at appropriate levels would be effective in abating degradation. Figure 4.22 presents the payoffs in a graphical form and the utility functions of both the government and the industrialists. The functions intersect at the incentives range of Kshs 1,000,000 and Kshs 4,999,000. This implies equilibrium (optimal point where finds) with the government find sufficient benefit to give incentives and the industrial users getting the motivation (due to economic gains) to abate degradation.

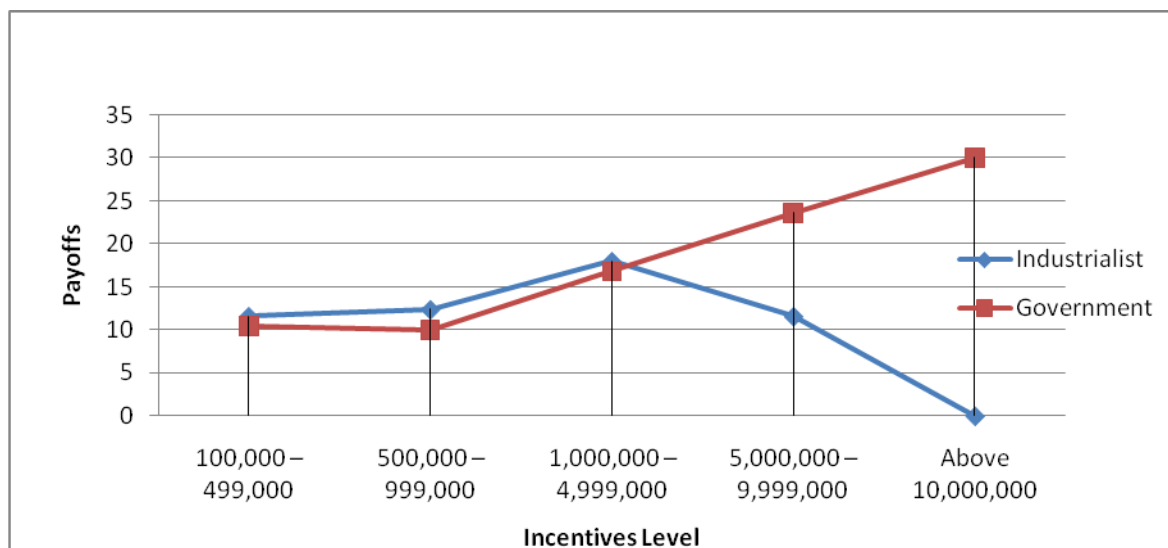


Figure 4.22: Utility functions for industrialist and government based on payoffs at different levels of incentives

4.4.5.2: Farmers responses to various levels of incentives

With the offer of incentives to farmers at different levels farmers registered varying responses as presented in Table 4.19.

Table 4. 19: Farmers Response to changes in levels of incentives

Incentive (Ksh)	Continue (No.)	Percentage (%)	Stop (No.)	Percentage (%)
10,000 – 20,000	23	48	25	52
21,000 - 50,000	17	35	31	65
51,000 - 100,000	8	17	40	83
101,000 – 500,000	4	8	44	92
Above 500,000	0	0	48	100

If the government chooses to set the incentives levels at ksh 10,000 to Ksh 20,000, 48 % of the farmers interviewed opt to continue with degradation. When the incentives levels are raised to between Ksh 21,000 and Kshs 50,000, 35% of the farmers still choose to continue with degradation. Raising the incentive further to between Ksh 51,000 and ksh 100,000 results in only 17% opting to continue with degradation. A further increase of incentives range between Ksh 101,000 and Ksh 500,000 leaves only 8% insisting on continuing with degradation. At incentive levels above Ksh 500,000 all the farmers choose to stop degradation. The incentives at this level bring more benefits than would accrue from activities contributing to degradation. Using these responses to play repeated prisoners dilemma game between the government and the farmers would result in the payoffs presented in table 4.20 below.

Table 4.20: Resultant payoffs from games played using farmers’ responses to different levels of incentives

Incentives Level	Payoffs	
	Farmer	Government
10,000 – 20,000	16.0	14.8
21,000 - 50,000	17.2	14.8
51,000 - 100,000	18.4	17.2
101,000 – 500,000	12.0	22.8
Above 500,000	0	30
Cumulative Payoffs	63.6	99.6
Average Score	12.72	19.92

The average score for the government stands at 19.92 whilst that of the farmers is at 12.72. This implies that the government’s objective of abating degradation by applying incentives as a policy intervention at the appropriate levels would be effective. The utility functions for the government and farmers plotted with payoffs at various levels are presented in Figure 4.23. The intersection of the two functions is at the incentives range of Kshs 51,000 to Kshs 100,000. This is the equilibrium (optimal point) for both the government and the farmers; the payoffs are almost equal within this range. It balances the economic interests of the farmers and environmental conservation interests of the government.

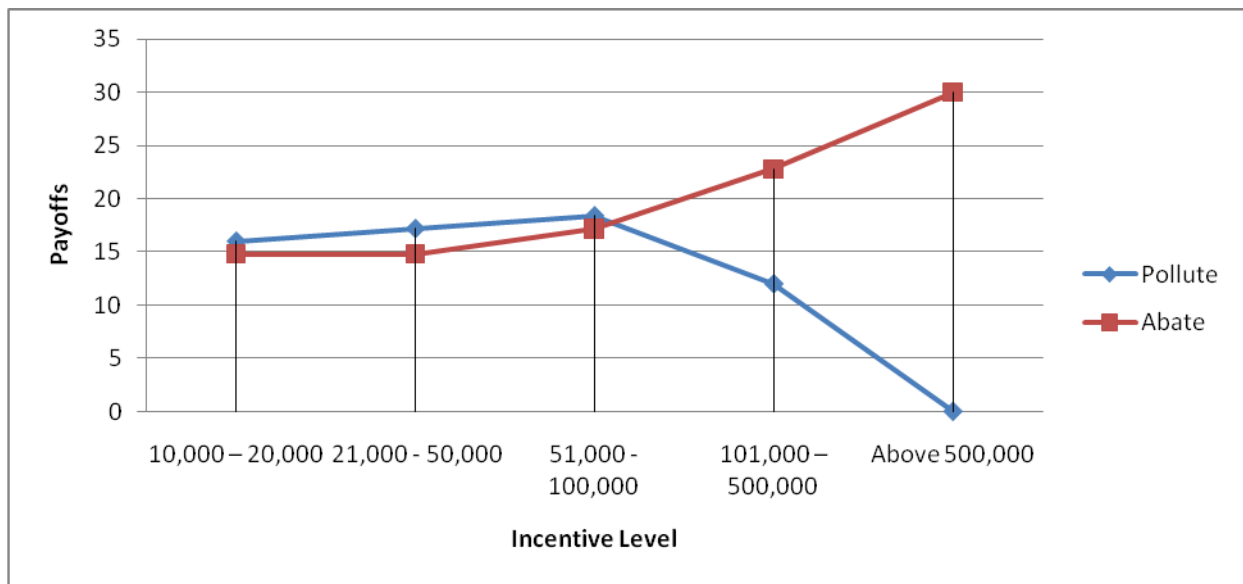


Figure 4. 21: Utility functions for farmers and government based on payoffs at different levels of incentives

4.4.5.3 Residential stakeholders responses government incentives

With the option of government offer of incentives to residential users to abate degradation the responses presented in Table 4.21 were obtained. At the incentives range of Ksh 10,000 to ksh

20,000, 64% of the residential users indicated that they would continue with degradation. Changing these levels to between Ksh 21,000 and Ksh 50,000 resulted in a reduction of those intending to continue within degradation to 35%. Further increases in incentives by the government to the range of Ksh 51,000 to Ksh 100,000 results in 16% of the residential stakeholders (users) persisting on with degradation activities. Taking the incentives levels to Ksh 101,000 and Ksh 500,000 leaves only 12% opting to continue with degradation. A shift of incentives to above Ksh 500,000 results in all residential stakeholders (users) ceasing degradation. It becomes non beneficial to the residential stakeholders to continue with degradation at this level of incentives.

Table 4. 21: Residential stakeholders’ responses to changes in levels of incentives

Incentive	Continue	Percentage	Stop (No.)	Percentage
Level (Ksh)	(No.)	(%)		(%)
10,000 – 20,000	78	64	43	36
21,000 - 50,000	42	35	79	65
51,000 - 100,000	19	16	102	84
101,000 – 500,000	15	12	106	88
Above 500,000	0	0	121	100

Taking these responses as a basis for playing repeated prisoners dilemma games between the government and the residential users’ results in payoffs that are presented in Table 4.22.

Table 4. 22: resultant payoffs from games played using residential users’ responses to different levels of incentives

Incentives Level	Payoffs	
	Continue	Stop
10,000 – 20,000	15.2	14.0
21,000 - 50,000	18.4	16.0
51,000 - 100,000	19.2	18.0
101,000 – 500,000	8	24.0
Above 500,000	0	30.0
Cumulative Payoffs	61.2	102
Average Score	12.24	20.4

The average payoffs (Score) for the government is Ksh 20.4 while that of the residential users is 12.24. This implies that incentives would be an effective measure for the government to apply in abating degradation arising from residential users if applied at the appropriate levels. When the score (payoffs) for both the government and the residential users are plotted in graph, the resultant utility functions appear as presented in Figure 4.23.

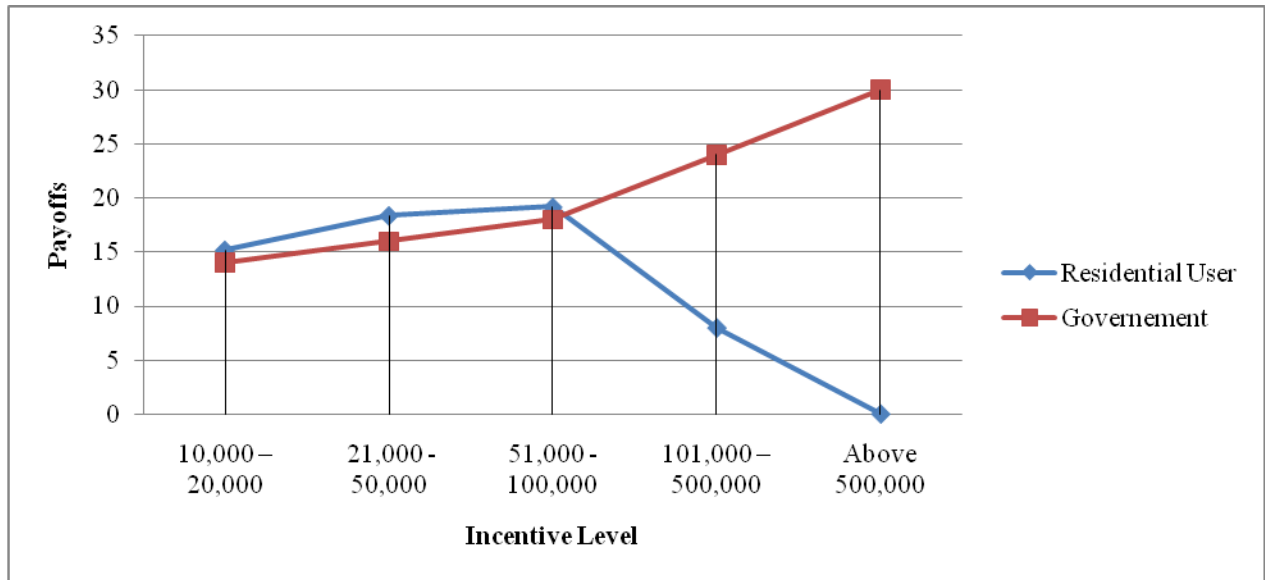


Figure 4.22: utility functions for residential users and government based on payoffs at different levels of incentives offered

The government and residential (users) utility functions intersect at the incentive levels between Ksh 51,000 and Ksh 100,000. This is the optimal (equilibrium) point at which the residential stakeholders' economic interests meet with the governments environmental considerations. Setting the incentives at these levels would yield the desired degradation abatement outcomes without frustrating the economic activities of residential stakeholders (users).

4.5 Chapter Summary

It has been established that the main drivers of water resources degradation in upper Athi river basin comprise; increased industrial, commercial, residential and agricultural developments. The major water users in upper Athi basin include the urban and rural population, irrigation, industries, livestock and wildlife. These users and their development needs are the main sources

of pressure on water resources in upper Athi river basin. The water resources in upper Athi river basin reflect a state of heavy degradation. The degradation is visually manifest in the black and green colouration of the water. The water is polluted with industrial and agro chemicals. The rivers are also contaminated with human and animal wastes. The riparian reserves have been encroached by human settlements and farming activities. The river system reflects high turbidity and sediments load.

Water resources degradation in the upper Athi river basin has impacted the rivers negatively. The increased dumping of wastes makes the water unsafe for domestic use. It in effect turns water into a health hazard. Sediments resulting from soil erosion and construction activities reduce water flows; adversely affects its quality; causes siltation and increases water infrastructure maintenance costs. It is therefore evident that water resources degradation inhibits the ability to supply water to drive economic activities, preserve biodiversity and sustain livelihoods.

There are several responses available to address the challenge of water resources degradation. These responses are use of institutional instruments; direct controls and regulation; establishment of water quality standards; economic and market instruments; technological production measures; changing social norms; public education; exerting consumer and investor pressure. Over reliance on command and control instruments has been cited as one of the issues limiting effective combat of water degradation problems in Kenya. Kenya has been found to have embraced command and control and institutional instruments in a more pronounced manner than other instruments.

Despite the potential of reinforcing the efforts to address water resource and environmental degradation afforded by these measures, there is a gap in the statutory and policy frameworks to

facilitate their implementation. Use of economic instruments and adoption of appropriate technology in production would require effective policy and statutory provisions that embed effective stakeholder participation.

It is evident that the measures currently being employed do not address the behavior of stakeholders (users) as economic agents within dynamic markets and social realities. This gap therefore necessitates the focus on gaining insight into how stakeholders (users) would respond to the application of the instruments for addressing degradation of water resources. Kenya has made tremendous progress in establishing policy, legal and institutional foundations for stakeholder participation in water and natural resource management. The Constitution being the supreme Law in Kenya has comprehensively framed the role of citizens in water and environmental resources management. It has afforded a social contract to the citizens that guarantees sustainable development and consolidates their roles in its achievement. It makes stakeholders participation mandatory. All public policy and service institutions including those dealing with natural resources are expected to comply with these requirements.

The Water policy of 1999 has been the key document that has guided legal and administrative reforms in the water sector in Kenya. It embraced IWRM and stakeholder participation in water resources management. With the promulgation of the Constitution of Kenya 2010, the need to review this policy to align with the constitutional provisions as well as address of implementation challenges emerged. This has occasion the drafting of the national water policy 2012 which is awaiting parliamentary debate and adoption. In addition the National environment policy 2014 has been adopted. The national environment policy compliments the provisions anchoring stakeholder participation made in the draft water policy 2012. These policy documents

have been found to correlate with the provisions of Rio principle 10 with respect to stakeholder participation in environmental management matters.

The key legislation that has been governing water resources management is the water Act 2002. The provisions of this Act embedded the IWRM principles and provide CAACs and WRUAs as the mechanisms for stakeholder participation at catchment levels. Following the passing of constitution of Kenya 2010 a need has emerged to review the water Act 2002. This has resulted in the enactment of Water Act 2016. Other key statutes that make key provisions in relation to stakeholder participation in water resources management include the EMCA2000 and EMCA amendments Act 2015. They provide for the processes on conducting Environmental Impact Assessments require stakeholders participation.

Gaps were however noted in the absence of framework law to guide public participation and set standards to guide on information needs, determination of suitable media, timeliness and methods for participation, The institutional arrangements for stakeholders' participation in water resources management span from national government and county governments to the catchments and local levels. The national government has policy and oversight institutions including; executive represented by the ministry in charge of water resources; the legislature (senate and national assembly); judiciary (environment and land court). These institutions are required by law to ensure stakeholder participation as they discharge their functions.

The institutions of county governments handling water resource management matters that include the implementation of policies set by the national government also serve as avenues for stakeholder participation. They include the county executive, county assemblies, and the citizens for a formed under the county government Act 2012. WRMA has been the key sectoral institution mandated with management of water resources in the country. It develops and

implements water resources management strategies in all the basin areas. It was required by the water Act to ensure stakeholder participation in its processes. CAACs were created under the water Act of 2002 to advise the regional offices of WRMA on matters of water resources management. These committees were meant to afford stakeholders an entry into the decision making processes of WRMA. A key gap observed in relation to the formation of the CAAC is that the law did not specify the proportion of members of the public relative to the co-opted public officers. This gave room for legitimate community views to be suppressed in decision making with respect to the mandate of CAAC. As much as the members of CAACs were referred to as public representatives; their appointment by the minister instead of being elected by local community, defeats the argument that they are representing the local community interest. Under the 2016 Water Act, the CAACs, have been replaced by basin Area Water Resources Committees though the gaps in law cited above persists.

There is also no legal obligation on the part of the Authority or its regional office to give any feedback to the committees regarding the advice that they have given. This gap leaves room for the regional offices and or the authority to proceed with implementation of water resource management strategies or decisions even in instances where they may have disregarded relevant advice of the committees. The performance of the committees is also left to be monitored administratively and is not legally pegged to any form of objective appraisal mechanisms or standards. This creates room for the Basin Area Water Committees to operate without accountability to the larger body of stakeholders and the public that they are meant to be representing. Their tenure is also left to the discretionary powers of the Cabinet Secretary.

WRUAs were established pursuant to Section 5(5) of the Water Act 2002, which required WRMA to formulate a catchment management strategy that encourages the establishment of

Water Resources Associations as for a conflict resolution and cooperative management of water resources in catchment areas. The discretion left to the Water Resources Authority with respect to formulation and functioning of WARUAs limits their pace of formations and thus inhibits stakeholder participation. Their voluntary membership nature also assumes the water users are willing to cooperate in and invest their time and resources in water management activities.

The provisions of Water Act 2016 enhance the roles of WRUAs as opposed to their limited scope under the 2002 water Act. It is however important to observe that establishment of WRUAs is still left to the discretion of the Authority. Further the questions of representation; equity and accountability in the process of establishing WRUAs is not addressed. The challenges to the legal registration of the WRUAs and the assumption that water users will volunteer to be members is still not covered by the Water Act 2016. The financial sustainability of the WRUAs is exposed to risks since the matter is left to the discretion of the Authority. It is evasively made a subject of memoranda between each WRUA and WRMA. Factors related to the participation process itself within WRUA such as organisation; communication; conflict resolution; transparency; equity and influence; stakeholder representativeness; integration of interests and definition of rules would significantly influence the quality of stakeholders participation in water resources management.

It was established that only 58% of the proposed WRUAs within upper part of Athi River basin are operational. This leaves a large portion of stakeholders not having any mechanism to participate in water resources management. In addition catchment area management plans and strategies are not implemented in the areas that lack WRUAs. The water resources in these areas are therefore left without stakeholder avenues for addressing degradation. Fewer females

participate in water resource management. The representation of younger persons in the WRUAs was found to be low. A majority of WRUAs members have levels of education that is above secondary education and can therefore comprehend water resource management policies. This means they have ability to effectively participate in water resource management.

A majority of the respondents (84%) had knowledge of existence Athi River catchment Area Management plan. However, only 46% were involved in its formulation. It is necessary to involve WRUA members in review and formulation of management plans to enhance their ownership of the implementation activities. The participation of WRUA members in water resource management would be enhanced if relevant technical and scientific information was availed. Access to information by members of WRUAs was rated positively though the need to keep information flowing through out emphasized. It is also important for inputs from stakeholders (members) to be incorporated in management plans.

Inclusivity aspects within WRUAs would be improved by WRMA being sensitive to stakeholder concerns such as language and interpretation during meetings. This notwithstanding the majority respondents indicated that WRUAs were inclusive. There is need to improve accountability in WRUAs with respect to reporting; monitoring and evaluation aspects which received significant negative rating. Transparency aspects in conduct of WRUAs business was rated positively though openness in budget processes was indicted by a significant number of respondents and should be improved.

WRUAs have had positive influence in water resource management and are therefore their performance by ensuring all stakeholders are involved in formulation of catchment area management plans, improvement of aspects of information access and inclusivity within WARUAs. Full activation and support of all proposed WRUAs is necessary to ensure that

participation of stakeholders is happening across the geographical scope of the basin. Inclusivity, relevance of information, income levels and education in years significantly influence participation of stakeholders in water resource management.

The government of Kenya has already adopted the use of fines as a measure for abating degradation of water resources. The levels of these fines were set by EMCA 1999 now amended by Environmental management and coordination amendment Act of 2015. The government of Kenya has been applying a policy measure of issuing waste disposal licenses to users as an intervention for abating degradation. The government has not put in place any policy of giving incentives to those who opt to invest or adopt measures that stop degradation.

The incentives intervention would yield positive results towards abating degradation with optimal levels falling in the range of Ksh 51,000 and Ksh 100,000. This study established that fines, waste disposal licenses and incentives are effective instruments for abating degradation and contributing to collective action of addressing deterioration of water quality. The levels of fines, license and incentives have to be set at appropriate levels informed by the behavior of different stakeholders (water resource users) in pursuit of the private interest. These levels should be graduated accordingly for the different interventions.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

This chapter provides the conclusions of the study covering issues emerging from the background, literature review, data analysis and discussions. It is highlighted in the background that Kenya has five major drainage basins that are closely related to geological structures. The country is classified as water stressed. It has low water endowment and does not meet the needs of its growing population. In addition to the pertaining supply and demand issues, Kenya has been witnessing serious water resources degradation challenges, including catchment encroachment and pollution of water courses.

The country has made efforts to address the above challenges by undertaking water sector reforms. The reforms have taken the nature of constitutional, statutory, policy and institutional changes. The changes have culminated in making water a human right, adopting the principle of subsidiarity and public participation separating the regulatory institutions and those water resource management, water use and infrastructure development. These reforms closely correlate with international soft law and principles relating to sustainable development and water resource management. It has however been noted that the laws and policies have yet to be fully aligned with the constitutional provisions. In addition the need developing institutional mechanisms that facilitate effective public participation still remains.

The implementation of the changes has seen Kenya adopt the approach of integrated water resources management IWRM, which is underpinned by principles of public participation, integration and decentralization. This has seen water management structures follow hydrological

boundaries along basins. It has brought forth the creation of CAACs and WARUAs as platforms for public participation. Despite the water sector reforms and the constitutional, legal, policy and institutional provisions for public participation in water resource management, results of effective participation are not evident. Cooperation of all stakeholders in management activities geared at reversing degradation appears low especially within the upper Athi River basin.

The study therefore aimed at assessing the drivers, pressures and impacts of water resources degradation in upper part of Athi River basin; examining the existing policies, laws and institutional arrangements for stakeholders participation in water resources management in Kenya. Analyzing the factors that influence stakeholders' participation in water resources management in upper Athi river basin; Analyzing stakeholders (users) responses to policy interventions addressing the water resources degradation challenges with a view to enhancing their cooperation in sustainable management of water resources in upper Athi River basin.

The literature review established that there are linkages between sustainable development and water resources management. Sustainable management of water resources is seen as being key to ensuring economic health and bringing forth societal wellbeing. Integrated water resource management IWRM is viewed as an appropriate approach for ensuring sustainable management of water resources. It has numerous advantages given its focus on achieving goals of sustainable development. It nonetheless has limitations in its assumption that stakeholders' participation will always yield the desired collective action necessary in sustainable water resource management. The focus in this study was therefore on seeking collective action of these interdependent actors (users) in water resource management and development.

The literature reviewed also revealed water degradation as a serious problem arising from both human and natural processes. In this regard the study was concerned with degradation arising

from human activities. Halting or reversing degradation would require strategies to prevent, treat or remedy. Prevention was found to be the cheapest, easiest and most effective way of protecting water quality. Stakeholder participation and decentralization are cited as key pillars of IWRM. Stakeholder participation is beneficial given its goals of promoting democracy, good governance and sustainable development. Giving voice to local actors (users) over decisions that affect them was found important in collectively deriving appropriate policy formulation and implementation. Accountability, transparency, inclusiveness, legitimacy, social learning, conflict resolution, effectiveness, efficiency and equity are found to be the key principles (elements) of stakeholder participation. They ought to be embedded in mechanisms that seek to enhance stakeholders' participation. Stakeholder participation is more effective in decentralized environment and therefore the focus of IWRM to decentralizing water management along hydrological boundaries (basin/catchment areas) is efficacious. It was therefore useful to the study to examine the stakeholder participation mechanisms available for water resource management in upper Athi River basin and Kenya in general to explore ways of having them enhanced.

Methodological review revealed that DPSIR framework is an effective tool for analysing the causes, impacts and reactions to changes in water systems. It is applicable in assessing the degradation of water resources in upper Athi river basin. A Logit regression analysis was also found useful in studying the factors that influence participation of stakeholders in water resource management. Game theoretic approaches emerged as being applicable to the simulation of stakeholder responses to management and policy interventions for halting degradation.

The theoretical framework for this research was founded on the subsidiarity principle and game theory. The subsidiarity principles origins were traced to the writings of Aristotle, Thomas Aquinas and social theory in the doctrines of the Catholic Church. The principle makes a case

for decisions to be made at the lowest possible levels. This reasoning provides the basis for advancing stakeholder (public) participation in water resources management. The principle is thus a foundational element of IWRM.

The assumption that stakeholders at the local level will make decisions and take actions that seek common good and collective action will seamlessly occur was found not to always hold. Individuals at times pursue separate interests that have negative consequences despite the state allowing them to participate in governance without impediments. Game theory was useful in explaining the behavior of different stakeholders (users) in relation to interventions that may be employed to motivate collective action that seeks common good. The study conceptualized to address the problem of resources degradation in Athi river basin despite reforms in constitution, legal and policy framework providing for sustainable management by enhancing collective action of stakeholders both voluntary and coerced.

5.1 The drivers, pressures and impacts of water resources degradation

The main drivers of water resources degradation in upper Athi river basin comprise; increased industrial, commercial, residential and agricultural developments. The major water users in upper Athi basin include the urban and rural population, irrigation, industries, livestock and wildlife. These users and their development needs are the main sources of pressure on water resources in upper Athi river basin. The water resources in upper Athi river basin reflect a state of heavy degradation. The degradation is visually manifest in the black and green colouration of the water. The water is polluted with industrial and agro chemicals. The rivers are also contaminated with

human and animal wastes. The riparian reserves have been encroached by human settlements and farming activities. The river system reflects high turbidity and sediments load.

Water resources degradation in the upper Athi river basin has impacted the rivers negatively. The increased dumping of wastes makes the water unsafe for domestic use. It in effect turns water into a health hazard. Sediments resulting from soil erosion and construction activities reduce water flows; adversely affects its quality; causes siltation and increases water infrastructure maintenance costs. It is therefore evident that water resources degradation inhibits the ability to supply water to drive economic activities, preserve biodiversity and sustain livelihoods.

There are several responses available to address the challenge of water resources degradation. These responses are use of institutional instruments; direct controls and regulation; establishment of water quality standards; economic and market instruments; technological production measures; changing social norms; public education; exerting consumer and investor pressure. Over reliance on command and control instruments has been cited as one of the issues limiting effective combat of water degradation problems in Kenya. The country has embraced command and control and institutional instruments in a more pronounced manner than other instruments.

Despite the potential of reinforcing the efforts to address water resource and environmental degradation afforded by these measures, there is a gap in the statutory and policy frameworks to facilitate their implementation. Use of economic instruments and adoption of appropriate technology in production would require effective policy and statutory provisions that embed effective stakeholder participation.

5.2 The policies, laws and institutional arrangements

Kenya has made tremendous progress in establishing policy, legal and institutional foundations for stakeholder participation in water and natural resource management. The Constitution being the supreme Law in Kenya has comprehensively framed the role of citizens in water and environmental resources management. It has afforded a social contract to the citizens that guarantees sustainable development and consolidates their roles in its achievement. It makes stakeholders participation mandatory. All public policy and service institutions including those dealing with natural resources are expected to comply with these requirements.

The Water policy of 1999 has been the key document that has guided legal and administrative reforms in the water sector in Kenya. It embraced IWRM and stakeholder participation in water resources management. With the promulgation of the Constitution of Kenya 2010, the need to review this policy to align with the constitutional provisions as well as address of implementation challenges emerged. This has occasioned the drafting of the national water policy 2012 which is awaiting parliamentary debate and adoption. In addition the National environment policy 2014 has been adopted. The National Environment policy compliments the provisions anchoring stakeholder participation made in the draft water policy 2012. These policy documents have been found to correlate with the provisions of Rio Principle 10 with respect to stakeholder participation in environmental management matters.

The key legislation that has been governing water resources management was the water Act 2002. The provisions of this Act embedded the IWRM principles and provide CAACs and WRUAs as the mechanisms for stakeholder participation at catchment levels. Following the passing of constitution of Kenya 2010 a need emerged to review the water Act 2002. This

resulted in the enactment of Water Act 2016. Other key statutes that make key provisions in relation to stakeholder participation in water resources management include the EMCA Act 1999 and EMCA amendments Act 2015. They provide for the processes on conducting Environmental Impact Assessments require stakeholders participation. Gaps were however noted in the absence of framework law to guide public participation and set standards to guide on information needs, determination of suitable media, timeliness and methods for participation

The institutional arrangements for stakeholders' participation in water resources management span from national government and county governments to the catchments and local levels. The national government has policy and oversight institutions including; executive represented by the ministry in charge of water resources; the Legislature (senate and national assembly); Judiciary (environment and land court). These institutions are required by law to ensure stakeholder participation as they discharge their functions. The institutions of county governments handling water resource management matters that include the implementation of policies set by the national government also serve as avenues for stakeholder participation. They include the county executive, county assemblies, and the citizens for a formed under the county government Act 2012.

WRMA has been developing and implementing water resources management strategies in all the catchment areas. It was required by the water Act 2002 to ensure stakeholder participation in its processes. CAACs were created under the water Act of 2002 to advise the regional offices of WRMA on matters of water resources management. These committees were meant to afford stakeholders an entry into the decision making processes of WRMA. A key gap observed in relation to the formation of the CAAC was that the law did not specify the proportion of members of the public relative to co-opted public officers. This left room for legitimate

community views to be disregarded in decision making with respect to CAACs mandate. As much as the members of CAACs are referred to as public representatives; their appointment by the minister rather than election by local community, defeats the argument that they are representing the local community interest. These committees have now been replaced by the Basin Area Water Resources committee under the provisions of the Water Act 2016

There was no legal obligation on the part of WRMA or its regional office to give any feedback to the CAACs regarding the advice that they have given. This gap left room for the regional offices and or the authority to proceed with implementation of water resource management strategies or decisions even in instances where they may have disregarded relevant advice of the CAACs. The performance of the CAACs was also left to be monitored administratively and is not legally pegged to any form of objective appraisal mechanisms or standards. This created room for the CAACs to operate without accountability to the larger body of stakeholders and the public that they are meant to be representing. These gaps are still not addressed by the Water Act 2016 since the relationship between the WRA and Basin Area Water Committees mirrors that of WRMA and CAACs.

WRUAs were established pursuant to Section 5(5) of the Water Act 2002, which required WRMA to formulate a catchment management strategy that encourages the establishment of Water Resources Associations as for a conflict resolution and cooperative management of water resources in catchment areas. They were governed under the Water Rules of 2006, particularly regarding formation and also registration with WRMA. The administrative discretion left to the Water Resources Authority (Previously WRMA) limits the pace with which they can be established and their financial sustainability. Their voluntary membership nature also assumes

the water users are willing to cooperate in and invest their time and resources in water management activities.

The provisions of Water Act 2016 enhance the roles of WRUAs as opposed to their limited scope under the 2002 Water Act. It is however important to observe that establishment of WRUAs is still left to the discretion of the Authority and basin water resource management committees. Further the questions of representation; equity and accountability in the process of establishing WRUAs is not explicitly addressed. The challenges to the legal registration of the WRUAs and the assumption that water users will volunteer to be members is still not covered by the Water Act 2016.

5.3 Factors influencing stakeholders participation in management of water resources

Factors related to the participation process itself within WRUA such as organisation; communication; conflict resolution; transparency; equity and influence; stakeholder representativeness; integration of interests; and, definition of rules would significantly influence the quality of stakeholders participation in water resources management.

It was established that only 58% of the proposed WRUAs within upper part of Athi River basin are operational. This leaves a large portion of stakeholders not having any mechanism to participate in water resources management. In addition catchment area management plans and strategies are not implemented in the areas that lack WRUAs. The water resources in these areas are therefore left without stakeholder avenues for addressing degradation. Fewer females participate in water resource management. The representation of younger persons in the WRUAs

was found to be low. A majority of WRUAs members have levels of education that is above secondary education and can therefore comprehend water resource management policies. This means they have the ability to effectively participate in water resource management. A majority of the respondents (84%) had knowledge of existence Athi River catchment Area Management plan. However, only 46% were involved in its formulation. It is necessary to involve WRUA members in review and formulation of management plans to enhance their ownership of the implementation activities.

The participation of WRUA members in water resource management would be enhanced if relevant technical and scientific information was availed. Access to information by members of WRUAs was rated positively though the need to keep information flowing through out emphasized. It is also important for inputs from stakeholders (members) to be incorporated in management plans.

Inclusivity aspects within WRUAs would be improved by WRMA being sensitive to stakeholder concerns such as language and interpretation during meetings. This notwithstanding the majority respondents indicated that WRUAs were inclusive. There is also need to improve accountability in WRUAs with respect to reporting, monitoring and evaluation aspects which received significant negative rating. Transparency aspects in conduct of WRUAs business was rated positively though openness in budget processes was indicted by a significant number of respondents and should be improved.

WRUAs have had positive influence in water resource management and are therefore their performance by ensuring all stakeholders are involved in formulation of catchment area management plans, improvement of aspects of information access and inclusivity within WARUAs. Full activation and support of all proposed WRUAs is necessary to ensure that

participation of stakeholders is happening across the geographical scope of the basin. Inclusivity, relevance of information, income levels and education in years significantly influence participation of stakeholders in water resource management.

5.5 Stakeholders' responses to policy interventions

Stakeholders' responses to fines, licenses and incentives as policy interventions for ensuring collective action to abate degradation of water resources were simulated using game theory based prisoners dilemma model. Responses of various categories of stakeholders (users) to government interventions to abate degradation are varied. The government of Kenya has already adopted the use of fines as a measure for abating degradation of water resources. The levels of these fines were set by EMCA Act 1999 now amended by Environmental management and coordination amendment Act of 2015.

Fines would be an effective intervention to abate degradation by industrialists but have to be placed at levels that balance their payoffs with those of the government to meet the sustainability criterion. Fines can be an effective tool for abating degradation by farmers in upper Athi River basin. They nonetheless have to be placed at levels that yield even payoffs between farmers and government. This would keep most farmers pursuing their economic activities while the government will keep enforcing fines with positive results.

Application of fines by the government as a policy measure to avert degradation of water resources by residential users would be effective when placed at levels that yield equilibrium payoffs. Residential users respond to the intervention of fines at a faster rate than those of

farmers. Similarly farmers respond at a faster rate than industrialists, although their equilibrium levels are within the same range.

The government has been applying a policy measure of issuing waste disposal licenses to stakeholders (users) as an intervention for abating degradation. Licenses are an effective tool for abating degradation caused by industrialists when placed at levels that balance the industrialist's payoffs with those of the government. Waste disposal license charges applied at levels that balance the pay offs of farmers with those of the government would be an effective tool for abating degradation emanating from farming activities within the upper Athi River basin. Similarly the license disposal charges would be effective in stopping degradation by residential users with the optimal levels being the equilibrium of payoffs of the government and residential users.

The simulations of responses to the use of license disposal charges as a tool for abating degradation indicate that the disposal license charge levels for industries should be pegged at higher levels than those of farmers and residential waste users.

The government of Kenya has not put in place any policy to give incentives to those who opt to invest or adopt measures that stop water resources degradation. Simulations of responses by industrialists indicate that incentives placed at levels that generate equilibrium payoffs would abate degradation by industrialist. Farmers would stop degradation if offered incentives at levels that balance payoffs between them and the government. The incentives intervention would yield positive results towards abating degradation by residential users with optimal levels yielding equal payoffs between them and the government.

This study established that fines, waste disposal licenses and incentives are effective instruments for abating water resources degradation and contributing to collective action by stakeholders in

addressing the degradation challenge. The fines, license and incentives have to be set at appropriate levels informed by the behavior of different stakeholders (users) in pursuit of their private interest. These levels should be graduated accordingly for the different interventions and impacts occasioned by non-cooperation by stakeholders.

5.6 Recommendations

5.6.1 Policy recommendations

5.6.1.1 Responses to water resources degradation

To address persisting challenges of water resource degradation the Kenyan government should review the water resources and environmental management policies, legal frameworks to fully provide for economic instruments, and technologies in production in addition to the existing institutional instruments. Below are specific recommendations.

Economic / Market Instruments: Amendments should be made to the environmental management and coordination Act, Water Act and Public revenue laws to provide for adoption and enforcement of economic instruments such as taxation to discourage commercial activities that contribute to degradation of water resources. The provisions should also specify mechanisms for providing incentives to water users such as industries, farmers and residential users for abating degradation or adopting production methods that do not make discharges that cause water resources degradation. In addition these laws should provide for giving of subsidies for implements and equipment that promote cleaner production and conservation farming methods. The taxes, fines, incentives and subsidies should be set at optimal levels (sustainable) and

reviewed based on research based behavior simulations of various categories of stakeholders (users). Provisions should also be made to allow sharing of benefits with stakeholders resulting from costs savings and revenue improvement arising from sustainable water management to motivate compliance and cooperation.

Technological production: The government should anchor in policy and law the promotion of technologies that eliminate the causes of water degradation from the various drivers and sources. These technologies include bio-digester for human wastes from residential estates, organic manures, organic pesticides and adoption of organic farming, use of cleaner production technologies.

Enhancing stakeholder participation: To enhance stakeholder participation in water resources management, gaps in policy and legal provisions relating to the participation processes from the national to the local levels will need to be addressed. Below are specific recommendations;

Framework law on public (stakeholders) participation in Kenya: The government should enact a framework law to guide public participation and set standards to guide on information needs, determination of suitable media, timeliness and methods for participation. This law should assign specific responsibilities to institutions dealing with public policy and services at all levels and provide accountability mechanisms that ensure participation decision making is meaningful.

Improved formation process and Representation in Basin Area Water Resources Committee: The Water Act should provide for the proportion of members of public (stakeholders) to be higher than the public officials in the BAWRCs. The law should also provide for the BAWRCs members representing the public to be nominated by WRUAs following a representative criterion that ensures equity in relation to gender, age, geographical and other relevant social cultural considerations. This will ensure a direct linkage between all the WRUAs and BAWRCs.

The Water Act in addition should make specific requirements for WRA to heed the advice of BAWRCs or provide objective reasons for dis regarding that advice.

WRUAs formation and sustainability in policy and law: WRUAs formation should be made mandatory in every sub-basin area. The registration of WRUAs should only be governed by the Water Act and no other Acts. The Water Act should provide for the membership criteria that ensures representation of all stakeholders and addresses matters relating to equity in terms of gender, generational, and other relevant social cultural considerations. The law should make issuance and renewal of licenses, permits and development approvals under EMCA and water Act conditional to active membership in WRUAs in the relevant sub basin areas. The water Act should make specific provision for WRUAs performance of water management functions to be mandatory rather than be left to discrete delegation by the Authority or the BAWRCs of functions of WRUAs. The Act should make provisions for the government to provide operational resources rather than leave it to the discretion of WRA and avoid dependency on donors.

Public Education in water resources management and environmental stewardship: The water Policy and water Act should make provisions to assign the functions of public education to water resources management and environmental management institutions at all levels (National, regional, county, and local).

5.6.2 Operational recommendations

The conclusions in chapter five have brought to the fore operational challenges experienced in addressing the problem of degradation and stakeholder participation processes. Below are specific recommendations for addressing those challenges;

5.6.2.1 Enforcement of regulations, controls and standards

The government should provide adequate financial and human resources to WRA, NEMA, and County level institutions charged with the responsibility of enforcing water quality and waste management regulations to improve their capacity to deal with stakeholders who contribute to water resources degradation. These resources should be matched with performance monitoring and evaluation. Good performance should be rewarded while poor performance should be met with sanctions.

5.6.2.2 Public reporting of activities undertaken by BAWRCs and WRUAs

BAWRCs and WRUAs should make their annual operational and financial reports public in media and other public arenas within their areas of operation to enhance accountability and public awareness. This will also contribute to enhancing public interest in water resources management activities.

5.6.2.2 Provision of relevant information to members of WRUAs

BAWRCs, NEMA and other government agencies in possession of technical, scientific, social, economic or cultural information relevant to water resources management should provide it to WRUAs in modes that are appropriate. This will enhance their efficacy in decision making. Communication channels between these agencies should be created to ensure feedback and information flow is unhindered.

5.6.2.3 Changing Social Norms

The government should initiate campaigns aimed at changing social norms and encouraging values, beliefs and attitudes that discourage water resource degradation. Such campaigns would for instance promote the adoption of waste recycling; water hygiene and sanitations in urban settlements.

5.6.2.4 Consumer and investor Pressure

Stakeholders, media and civil societies working in degradation prone areas of Athi River basin and other basins should engage in campaigns to publicize poor practices the entities causing degradation of water resources to the detriment of the public. NEMA and BAWRCs should seek partnership with media and civil society to campaign against industries and investors whose activities can be directly linked to water resource degradation and pollution.

5.6.3 Further Research recommendations

Further research is recommended on the following issues;

- (i) The production technologies and production methods that could be adopted by industries in upper Athi basin to eliminate waste discharges that result in water resources degradation.
- (ii) The valuation of economic and environmental impacts of water resources degradation in upper Athi river basin.

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APPENDIX 1
ADDRESSING DEGRADATION OF WATER RESOURCES THROUGH IMPROVED
STAKEHOLDER PARTICIPATION IN UPPER ATHI RIVER BASIN
QUESTIONNAIRE

This questionnaire aims at gathering information to analyze responses to policy interventions for addressing degradation of water resources in Upper Athi River basin

INSTRUCTIONS

- i. Please complete every item honestly
- ii. Make comments where necessary.
- iii. Respondents name may not be written in the questionnaire.

CONSENT

Mr. Kiambi Mwenda Makathimo, a Ph.D. Candidate of Environmental Policy at the University of Nairobi is conducting a study on Addressing Degradation of Water Resources through improved stakeholder participation in upper Athi River basin. In order to undertake the study, it is important to collect some data from water resource users within the Upper Athi River Basin. The information is being collected for academic purposes only and there are therefore no personal benefits or risks to your participation. The information received will be handled with utmost confidentiality; therefore, the only identifier on the questionnaire will be the questionnaire code. The interview will take approximately 20 minutes and we'll appreciate if you can answer all the questions. For more information about this study, please contact the researcher on the following number 0722 710 304 or email: makathimo@ldgi.org

1. Consent Granted: YES (proceed with interview)
2. NO (thank person and move to the next respondent)

INDUSTRIALISTS SURVEY QUESTIONNAIRE

SECTION A: FIRM IDENTIFICATION AND INTERVIEW BACKGROUND

Start time (00:00)		End time(00:00)	
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	DD/MM/YYYY	Name		Comments
Date visit		Interviewer		
Date entered		Entered by:		

Name of Interviewee (Respondent)		Name of The firm	
Designation		Years in operation	

Variable	Response	Comments
County		
Sub-County/District		
Division		
Location		
Sub-location		

SECTION B:

Q. No.	Question	Response	Comments
B1.	Please state the nature/type of your industry.	1. Food processing [] 2. Timber products [] 3. Metal fabrication [] 4. Fertilizer manufacturing [] 5. Other.....(specify)	
B2.	Where do you get water for you use in your industry from?	Rain harvesting [] Ground well/borehole [] Piped mains supply [] Independent water vendors [] Direct from the river []	

		Other.....(specify)	
B3.	In the order of 1 to 7, Rank The following uses of the River from the most important to the least important.	Source of water for irrigation..... Domestic use..... Livestock..... Recreation (specify)..... Industrial use..... For dumping waste..... Commercial use (e.g. water for sale).....	
B4.	In the ranking order of 1 to 4, who do you consider to be the greatest contributor to degradation/ pollution of the river among the following:	Farmers Urban settlements Industries..... Institutional users e.g. Schools, hospitals.....	
B5	Who in your opinion do you consider to be the greatest contributor to degradation / pollution of the river among the following:	1. Farmers [] 2. Urban Settlements [] 3. Industries [] 4. Institutional users' e.g. Schools, Hospitals etc []	
B6.	Are you aware of the set levels of license fees for waste disposal / effluent into the river?		

B7.	What are your possible reactions to pollution if the government was to issue waste disposal license with limits indicated.	Disposal License	Reaction			
			Continue	Decrease	Stop	
		10,000 – 49,000				
		50,000 – 99,000				
		100,000 – 499,000				
		500,000 – 999,000				
		Above 1000,000				
B8.	Do you have any information on the provisions of waste management regulations by the government of Kenya?	1. YES [] 2. NO []				
B9.	If the government was to fine those who pollute/ discharge	Government	Reaction			
			Continue	Decrease	Stop	

	waste into the river as per Environmental Management and Conservation Act (EMCA) kindly indicate your expected likely outcome on the table.	Fines				
		100,000 – 499,000				
		500,000 – 999,000				
		1000,000 - 9,999,000				
		Above 10,000,000				
B10	If the government was to offer incentives for industries willing to take measures against release of effluent/ waste into the river, what in your opinion would be the resultant action at the following levels of incentives?	Government Incentives	Reaction			
			Continue	Decrease	Stop	
		100,000 – 499,000				
		500,000 – 999,000				
		1000,000 - 9,999,000				
		Above 10,000,000				

B11	<p>If the government were to impose an extra tax on annual income on waste disposal/ discharge into the river, what do you think would be the alternative ways of disposing or handling waste by Industries to avoid such a tax?</p>	<ol style="list-style-type: none"> 1. Incineration (burning of waste) 2. Construct a treatment facility 3. Sanitary Landfill 4. Total recycling (cleaner production) 		
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APPENDIX 2
ADDRESSING DEGRADATION OF WATER RESOURCES THROUGH IMPROVED
STAKEHOLDER PARTICIPATION IN UPPER ATHI RIVER BASIN
QUESTIONNAIRE

This questionnaire aims at gathering information to analyze responses to policy interventions for addressing water resources degradation in Upper Athi river basin

INSTRUCTIONS

- i. Please complete every item honestly.
- ii. Make comments where necessary.
- iii. Respondents name may not be written in the questionnaire.

CONSENT

Mr. Kiambi Mwenda Makathimo, a Ph.D. Candidate of Environmental Policy at the University of Nairobi is conducting a study on Addressing Degradation of Water Resources through improved stakeholder participation in upper Athi River basin. In order to undertake the study, it is important to collect some data from water resource users within the Upper Athi River Basin. The information is being collected for academic purposes only and there are therefore no personal benefits or risks to your participation. The information received will be handled with utmost confidentiality; therefore, the only identifier on the questionnaire will be the questionnaire code. The interview will take approximately 20 minutes and we'll appreciate if you can answer all the questions. For more information about this study, please contact the researcher on the following number 0722 710 304 or email: makathimo@ldgi.org

1. Consent Granted: YES (proceed with interview)
2. NO (thank person and move to the next respondent)

RESIDENTIAL USERS QUESTIONNAIRE

SECTION A: HOUSEHOLD IDENTIFICATION AND INTERVIEW BACKGROUND

Start time (00:00)		End time(00:00)	
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	DD/MM/YYYY	Name		Comments
Date visit		Interviewer		
Date entered		Entered by:		

Name of Interviewee (Respondent)		Size of household	
Address			

Variable	Response	Comments
County		
Sub-County/District		
Division		
Location		

Sub-location		
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SECTION B:

Q. No.	Question	Response	Comments
B1.	Please state the type of your residence?	1. Permanent [] 2. Semi permanent [] 3. Temporary []	
B2	What is the nature of your settlement?	4. Informal [] 5. Formal []	
B3	Kindly indicate your land tenure.	1. Free hold (has title deed) [] 2. Lease [] 3. Temporary occupation [] 4. Tenant []	
B4.	Where do you get water for use in your household from?	Rain harvesting [] Ground well/borehole [] Piped mains supply [] Independent water vendors []	

		Direct from the river [] Other.....(specify)	
B5.	In the order of 1 to 7, Rank the following uses of the River from the most important to the least important.	Source of water for irrigation..... Domestic use..... Livestock..... Recreation (specify)..... Industrial use..... For dumping waste..... Commercial use (e.g. water for sale).....	
B6.	In ranking order of 1 to 4, who do you consider to be the greatest contributor to degradation/ pollution of the river among the following?	Farmers Urban settlements Industries..... Institutional users e.g. Schools, hospitals.....	
B7	In the ranking order of 1 to 4, Who in your opinion would benefit most if discharge of waste/degradation/ pollution of the river stopped?	Farmers Urban Settlements Industries Institutional users e.g. Schools, Hospitals e.t.c.....	

B8.	Are you aware of the set levels of license fees for waste disposal / effluent into the river?	1. YES [] 2. NO []				
B9.	What are your possible reactions to pollution if the government was to issue waste disposal license with limits indicated.	Disposal License	Reaction			
			Continue	Decrease	Stop	
		10,000 – 20, 0000				
		21,000 – 50,000				
		51,000 – 100,000				
		101,000 - 500,000				
		Above 500,000				
B10.	Are you aware of waste management regulations by the government of Kenya?	1. YES [] 2. NO []				
B11.	If the government was to fine those who pollute/ discharge waste into the river as per	Governme nt Fines	Reaction			
			Continue	Decrease	Stop	

	Environmental Management and Conservation Act (EMCA)	100,000 – 499,000				
	kindly indicate your expected likely outcome on the table	500,000 – 999,000				
		1000,000 – 9,999,000				
		Above 10,000,000				
B12	If the government was to offer incentives to those who adopt measures against in appropriate domestic waste disposal, what would be your expected outcomes with respect to pollution/ degradation when incentives are set at each of the levels shown in the table?	Government Incentives	Reaction			
			Continue	Decrease	Stop	
		10,000 – 20, 0000				
		21,000 – 50,000				
		51,000 – 100,000				
		101,000 - 500,000				

		Above 500,000			
B13	If the government were to impose an extra tax on annual income on waste disposal/ discharge into the river, what do you think would be the alternative ways of disposing or handling waste by urban settlers to avoid this tax?	5. Incineration (burning of waste) 6. Construct a treatment facility 7. Sanitary Landfill 8. Total recycling (cleaner production)			

APPENDIX 3
ADDRESSING DEGRADATION OF WATER RESOURCES THROUGH IMPROVED
STAKEHOLDER PARTICIPATION IN UPPER ATHI RIVER BASIN
QUESTIONNAIRE

This questionnaire aims at gathering information to analyze responses to policy interventions for addressing degradation of water resources in Upper Athi River Basin.

INSTRUCTIONS

- i. Please complete every item honestly.
- ii. Make comments where necessary.
- iii. Respondents name may not be written in the questionnaire.

CONSENT

Mr. Kiambi Mwenda Makathimo, a Ph.D. Candidate of Environmental Policy at the University of Nairobi is conducting a study on Addressing Degradation of Water Resources through improved stakeholder participation in upper Athi River basin. In order to undertake the study, it is important to collect some data from water resource users within the Upper Athi River Basin. The information is being collected for academic purposes only and there are therefore no personal benefits or risks to your participation. The information received will be handled with utmost confidentiality; therefore, the only identifier on the questionnaire will be the questionnaire code. The interview will take approximately 20 minutes and we'll appreciate if you can answer all the questions. For more information about this study, please contact the researcher on the following number 0722 710 304 or email: makathimo@ldgi.org

1. Consent Granted: YES (proceed with interview)

2. NO (thank person and move to the next respondent)

FARMERS SURVEY QUESTIONNAIRE

SECTION A: FARMERS IDENTIFICATION AND INTERVIEW BACKGROUND

Start time (00:00)		End time(00:00)	
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	DD/MM/YYYY	Name		Comments
Date visit		Interviewer		
Date entered		Entered by:		

Name of Interviewee (Respondent)		Address	
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Variable	Response	Comments
County		
Sub-County/District		
Division		

Location		
Sub-location		

SECTION B:

Q. No.	Question	Response	Comments
B1.	What type of farming do you practice?	1. Small scale [] 2. Large Scale []	
B2.	Where do you get water for use in your farm from?	Rain harvesting [] Ground well/borehole [] Piped mains supply [] Independent water vendors [] Direct from the river [] Other.....(specify)	
B3.	In the order of 1 to 7, Rank the following uses of the River from the most important to the least important.	Source of water for irrigation..... Source of water for domestic use..... Water for livestock..... Recreation (specify)..... Industrial use.....	

		For dumping waste..... Commercial use (e.g. water for sale).....																
B4.	In ranking order of 1 to 4 who do you consider to be the greatest contributor to degradation/ pollution of the river among the following?	Farmers Urban settlements Industries..... Institutional users e.g. Schools, hospitals.....																
B5	In the ranking order of 1 to 4, Who in your opinion would benefit most if discharge of waste/degradation/ pollution of the river stopped?	Farmers..... Urban Settlements..... Industries..... Institutional users e.g Schools, Hospitals etc.....																
B6.	Are you aware of the set levels of license fees for waste disposal / effluent into the river?	3. YES [] 4. NO []																
B7.	What are your possible reactions to pollution if the government was to issue waste disposal license with limits indicated.	<table border="1"> <thead> <tr> <th rowspan="2">Disposal license</th> <th colspan="3">Reaction</th> </tr> <tr> <th>Continue</th> <th>Decrease</th> <th>Stop</th> </tr> </thead> <tbody> <tr> <td>10,000 – 20, 0000</td> <td></td> <td></td> <td></td> </tr> <tr> <td>21,000 –</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Disposal license	Reaction			Continue	Decrease	Stop	10,000 – 20, 0000				21,000 –				
Disposal license	Reaction																	
	Continue	Decrease	Stop															
10,000 – 20, 0000																		
21,000 –																		

		50,000				
		51,000 – 100,000				
		101,000 – 500,000				
		Above 500,000				
B8.	Do you have any information on the provisions of waste management regulations by the government of Kenya?	<p>1. YES []</p> <p>2. NO []</p>				
B9.	If the government was to fine those who pollute/ discharge waste into the river as per Environmental Management and Conservation Act (EMCA) kindly indicate your expected likely outcome on the table.	Government Fines	Reaction			
			Continue	Decrease	Stop	
		100,000 – 499,000				
		500,000 – 999,000				
		1000,000 – 9,999,000				
		Above				

		10,000,000				
B10	If the government was to offer incentives for farmers willing to adopt farming methods that deter pollution/degradation, what would be your expected outcomes if the incentives were set at the levels (in Ksh) shown in the table.	Government Incentives	Reaction			
			Continue	Decrease	Stop	
		10,000 – 20,000				
		21,000 – 50,000				
		51,000 – 100,000				
		Above 500,000				
B11	If the government were to impose an extra tax on annual income on waste disposal/ discharge into the river, what do you think would be the alternative ways of disposing or handling waste by farmers to avoid such tax?	9. Incineration (burning of waste) 10. Construct a treatment facility 11. Sanitary Landfill 12. Total recycling				

		(cleaner production)		
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APPENDIX 4
ADDRESSING DEGRADATION OF WATER RESOURCES THROUGH IMPROVED
STAKEHOLDER PARTICIPATION IN UPPER ATHI RIVER BASIN

QUESTIONNAIRE

This questionnaire aims at gathering information to examine the factors that influence stakeholders' participation in water resources management in Upper Athi River Basin

INSTRUCTIONS

- i. Please complete every item honestly.
- ii. Make comments where necessary.
- iii. Respondents name may not be written in the questionnaire.

CONSENT

Mr. Kiambi Mwenda Makathimo, a Ph.D. Candidate of Environmental Policy at the University of Nairobi is conducting a study on Addressing Degradation of Water Resources through improved stakeholder participation in upper Athi River Basin. In order to undertake the study, it is important to collect some data from water resource users within the Upper Athi River Basin. The information is being collected for academic purposes only and there are therefore no personal benefits or risks to your participation. The information received will be handled with utmost confidentiality; therefore, the only identifier on the questionnaire will be the questionnaire code. The interview will take approximately 20 minutes and we'll appreciate if you can answer all the questions. For more information about this study, please contact the researcher on the following number 0722 710 304 or email: makathimo@ldgi.org

1. Consent Granted: YES (proceed with interview)

2. NO (thank person and move to the next respondent)

SECTION A: IDENTIFICATION AND INTERVIEW BACKGROUND

Start time(00:00)		End time(00:00)	
--------------------------	--	------------------------	--

	DD/MM/YYYY	Name		Comments
Date visit		Interviewer		
Date entered		Entered by:		

Variable	Response	Comments
County		
Sub-County/District		
Division		
Location		
Sub-location		

SECTION B: DEMOGRAPHIC CHARACTERISTICS

Q. No.	Question	Response		Comments
B1.	Age of the respondent (in years)			
B2.	Education	Level	Years	
		1. Primary		
		2. Secondary		
		3. College		
		4. University		
B3	Marital status	1. Single [] 2. Married [] 3. Divorced [] 4. Widowed []		
B4	What is your main occupation?			
B5	Gender	1. Male [] 2. Female []		
B6	Household size (in numbers)			

B7	What is your average income per month?	1. 0 – 5,000 [] 2. 5,000- 50,000 [] 3. 50, 000-100,000 [] 4. Above 100,000 []	
SECTION C			
RATING USERS' PARTICIPATION IN WATER RESOURCE MANAGEMENT			
C1	What mechanisms are in place for interaction between stakeholders at the basin level?		
C2	What mechanisms are in place for public participation in water matters at your level?		

SECTION D:

EXAMINING PARTICIPATION IN FORMULATION AND IMPLEMENTATION OF CATCHMENT AREA MANAGEMENT PLANS

		N/A	Yes	No
D1	Are you aware of the existence of Athi River Basin Catchment Management Plan?			
D2	Were you involved in the formulation of the Athi River Basin Catchment Management Plan?			

D3	Does the Catchment Management Plan help make decisions based on good science?			
D4	Does the Catchment Management Plan help achieve equitable benefit for all sectors of the community?			
D5	Does the Catchment Management Plan help conserve non renewable resources, by encouraging efficient use while seeking for alternatives?			
D6	Does the Catchment Management Plan help in maintaining ecological and socio-cultural values?			
D7	Does the Catchment Management Plan help in enhancing regional prosperity, by ensuring sustainable use of catchment assets?			
D8	Does the Catchment Management Plan help in maintaining and/or improving water security?			
D9	Does the Catchment Management Plan help to strengthen understanding, participation and partnerships among the community and all stakeholders in the catchment area?			
D10	Are you involved in any other project promoting conservation of Athi River Basin resources?			

SECTION E

ASSESSING DIALOGUE ON WATER RESOURCES MANAGEMENT.

		N/A	Yes	No
E1	Is communication owned by all stakeholders of this WRUA/CAAC?			
E2	Are lines of communication clearly defined between all stakeholders of the WRUA/CAAC?			
E3	Are basin stakeholder given equal chances to communicate and give feedback?			
E4	Do water experts take part in the meetings and are they readily available to stakeholders?			
E5	Are the government officers sensitive to basin stakeholder concerns?			
E6	Are the methods of communication appropriate to all WRUA/CAAC members?			
E7	Is there honest working relationship between basin stakeholders and water management officials?			
E8	Are stakeholders ability to participate incorporated in planning of WRUA stakeholder meetings?			

		Answer	Comments
E9	What do you think can be done to improve dialogue among stakeholders?		
E10	Do you feel that dialogue among members of	1. Yes []	

	the WRUA helps averting river degradation?	2. No []	
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**SECTION F: ASSESSING RELEVANCE OF INFORMATION RELIED UPON BY
STAKEHOLDERS**

		N/A	Yes	No
F1	Are all relevant social, environmental and economic activities affecting Athi River Basin assessed and identified?			
F2	Is relevant technical and scientific information and analysis provided to the basin stakeholders?			
F3	Is information provided in a form that is understandable in a way that helps basin stakeholders make informed decisions?			
F4	Are all basin stakeholders assured of easy access to information about Athi River Basin?			
F5	Is available information delivered in a culturally appropriate manner to all basin stakeholders?			
F6	Are opportunities provided to basin stakeholders to raise queries on any information given and make extra contributions?			

		Answer	Comments
F7	What are your suggestions to help improve the manner of passing information among the		

	WRUA/CAAC members?		
F10	Do you feel that the information provided helps members of the WRUA/CAAC appreciate the importance of conserving the river basin?	1. Yes [] 2. No []	

SECTION G: ASSESSING RESPECT FOR TIMELINES IN WATER RESOURCE

MANAGEMENT ACTIVITIES

		N/A	Yes	No
G1	Are views by stakeholders sought as early as possible in water policy/Plans development?			
G2	Are relationships, capacities and knowledge recognized and built before decisions on basin use are made?			
G3	Is there time given during meetings for stakeholder’s free expression?			
G4	Are the timeframes for stakeholder input realistic?			
G5	Is engagement maintained in throughout ?			
G6	Are stakeholder timeframes respected?			
G7	Is information provided to stakeholders within the stipulated timeframes and deadlines?			
G8	Is timing convenient to allow all stakeholders representation?			
G9	Are changes to timeframes recognized respected and accommodated where necessary?			

		Answer	Comments
G10	How would you rate timeliness during stakeholder consultations?	1. Very []] 2. good [] 3. Good []] 4. Poor []] 5. Very poor []	
G11	Give your suggestions on how timeliness can be improved in planning and implementation of the basin management agenda.		

SECTION H: ASSESSING TRANSPARENCY IN WATER RESOURCE

MANAGEMENT PROCESSES

		N/A	Yes	No
H1	Are policy/ planning objectives and desired outcomes clearly articulated?			
H2	Are objectives of the stakeholders identified?			

H3	Are decisions making processes negotiated to ensure that stakeholders understand government objectives?			
H4	Are boundaries of the engagement process set?			
H5	Are mechanisms feedback process between stakeholders put in place?			
H6	Are stakeholders of the basin informed immediately on any changes on agreed outcomes?			
H7	Are views and feedbacks of all stakeholders openly reported without any bias?			
H8	Is budget process open and participatory?			
H9	Is level of influence of stakeholders involved in the process established?			

		Answer	Comments
H10	Do you feel that transparency is observed during stakeholder meetings?	1. Yes [] 2. No []	
H11	What would you suggest to help improve transparency during your WRUA/CAAC consultations?		

SECTION I: EXAMINING REPORTING

		N/A	Yes	No
I1	Are decisions and outcomes of meetings with stakeholders well documented?			
I2	Are stakeholders updated regularly on policy implementations and the various policy outcomes and progress?			
I3	Is implementation progress verified when appropriate and practicable with clear indicators?			
I4	Is financial reporting done transparently by following all financial standards?			

		Answer	Comments
I5	Is reporting in your WRUA/CAAC effective enough to satisfactorily serve your purpose?	1. Yes [] 2. No []	
I6	What would you suggest to help improve reporting during your WRUA/CAAC consultations?		

SECTION J: ASSESSING COLLABORATION

		N/A	Yes	No
J1	Does the government provide sufficient resources when stakeholders engage?			
J2	Are experts invited to share with the stakeholders?			
J3	Do government and stakeholders work in cooperation?			
J4	Are outcomes owned jointly by all the stakeholders?			
J5	Are mutually beneficial outcomes, to all stakeholders sought where feasible?			
J6	Are stakeholder issues dealt with comprehensively with their responses sought in?			
J7	Is independent mediation process considered when dealing with disagreements and disputes between stakeholders?			

		Answer	Comments
J8	In your opinion, is teamwork achieved during stakeholder forums?	1. Yes [] 2. No []	
J9	What are your suggestions to help foster teamwork in your WRUA/CAAC?		

SECTION K: ASSESSING HOW REPRESENTATIVE THE ATHI RIVER BASIN

STAKEHOLDER ENGAGEMENT PLATFORMS ARE:

		N/A	Yes	No

K1	Are the relevant stakeholders identified while recognizing they may change over time?			
K2	Are stakeholder issues, interests' aspirations and concerns identified to better define what matters to them?			
K3	Is stakeholder engagement facilitated financially by government as part of policy process?			
K4	Is culture and heritage of stakeholders respected?			
K5	Are different agendas of stakeholders accepted while ensuring that dominant groups are not the only voices heard?			
K6	Are the minorities and other marginalized groups appropriately represented?			
K7	Is there a plan to tailor make engagement strategies to meet the needs of all stakeholder groups, their accessibility and information needs?			
K8	Is gender parity ensured when constituting stakeholder meetings?			
K9	Are the interests of various age groups considered during stakeholder meetings?			
K10	Are diverse social economic statuses of stakeholders considered during stakeholder meetings to ward off influence from affluent users?			
K11	Are stakeholders meetings privy of the religious backgrounds of users?			

		Answer	Comments
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K12	What criteria are used to select members of the WRUA/CAAC?	1. Yes [] 2. No []	
K13	How is gender balance achieved when selecting members of the WRUA/CAAC?		

SECTION L: RATING INTEGRITY

		N/A	Yes	No
L1	Is the stakeholder consultation process you are involved in well explained?			
L2	Are the ground rules for the stakeholder consultation process agreed on, and obeyed?			
L3	Is the stakeholder engagement process open?			
L4	Are the decisions to be made outside the scope of the stakeholder engagement process clear?			
L5	Are the decisions that are not negotiable in the stakeholder engagement process clarified and reasons for the decision provided?			
L6	Are achievable targets set and agreed in the stakeholder engagement process?			
L7	Is reporting on progress of the stakeholder engagement accurate and prompt?			

L8	Is responsibility taken on water management actions and promises by the water management authorities?			
L9	Are values, mission and vision of water management authorities consistent with the practice at the local level?			
L10	Are all stakeholder views and concerns respected and responded to?			
L11	Are all stakeholders treated fairly with no discrimination?			
L12	Are legal, ethical and human rights respected?			
L13	Is honesty practiced even when the news to be passed to stakeholders is not good?			