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OVERVIEW OF ENVIRONMENTAL POLICY ON SAND HARVESTING AND ITS EFFECT TO THE SUSTAINABILITY OF RIVERS IN MAKUENI COUNTY

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ABSTRACT

Purpose of the Study: The researcher sought to answer three questions: What are the environmental policy frameworks that govern sand harvesting? Why do people harvest sand in Makueni? What should be done to protect rivers?

Statement of the Problem: This paper gives an overview of environmental policy on sand harvesting and its sustainability of rivers in Makueni County. Nairobi is endowed with skyscrapers that endow its skies. What few people may not know is that these beautiful towers are built by natural resources that are transported from the rural semi-arid areas of Kenya. Indiscriminate exploitation of sand deposits that retain water in seasonal rivers is fast creating a huge environmental catastrophe. A great percentage of trailers that soar traffic along the Nairobi-Mombasa highway are used to ferry sand and stones from the Makueni to construction sites in Nairobi. When you look to your left, right, in-front or behind you, you will likely see a skyscraper under construction, thanks to the continuous supply of river sand which is most preferred by constructors. Haulage of sand by heavy trucks causes environmental degradation by accelerating soil erosion and affecting soil stability. Storage of sand causes destruction of surface areas through clearing of vegetation and uses land that could be used for irrigation.

Methodology: This study adopted interpretivist philosophical paradigm and employed a qualitative research approach which involved collection and analysis of non-numerical data from first-hand observation, interviews, focus groups, recordings and participant observations in order to generate new knowledge about the phenomenon of interest. The researcher employed exploratory research design to help her probe further the study area.

Result: Related social and economic problems included conflict school drop-out rate leading to serious socio-economic problems. The positive effects of sand harvesting include local employment; however, the share of monetary benefits to locals is minimal as the larger share goes

to the sand barons and cartels. The results showed that the local community gained the least from sand harvesting, but stood to lose the most if the depletion of river resources continued.

Conclusion: As a mitigation plan towards addressing negative outcomes of sand harvesting that we have seen in the discussion, the researcher planned to implement a number of strategies by way of adopting an advocacy planning cycle: one (workshop & all stakeholders); two – explore alternative construction technologies that do not use sand. Singapore has successfully adopted Ferrocement and Koto concepts of construction which uses very minimal sand or none. By so doing, the researcher hoped that this thought-provoking ideas would contribute to the abolishment of sand harvesting in Makueni County. The researcher hopes that the Citizenship Responsible Behaviour will provoke all stakeholders in preparing the County towards the adoption of environmentally friendly construction alternatives as well as help the Government in achieving one of its Big Four agenda items of affordable housing and ecological balance.

Recommendation: Suggestions were made for safe and sustainable methods of managing sand harvesting, in which greater national and local policy revision and enforcement of regulations is necessary to protect the environment.

Keywords*: Environmental Policy, Sand Harvesting, Sustainability of Rivers, Makueni County*

INTRODUCTION

The capital city of Kenya, Nairobi, is the largest city in East Africa, with a population of over 5 million people. It has its skyline bedecked with imposing skyscrapers, all built from sand and stones mined from Arid and Semi-Arid (ASAL) region of Eastern Kenya. Approximately 175,484 tonnes of sand are harvested yearly in the greater Makueni County (Mutiso, 2014). Indiscriminate exploitation of sand deposits that retain water in seasonal rivers is fast creating a huge environmental catastrophe. A great percentage of trailers that soar traffic along the Nairobi-Mombasa highway are used to ferry sand and stones from the Makueni to construction sites in Nairobi. When you look to your left, right, in-front or behind you, you will likely see a skyscraper under construction, thanks to the continuous supply of river sand which is most preferred by constructors.

According to UNEP (2019) report, uncontrolled sand harvesting results to reduced availability of water in riverbeds, drying of boreholes and increased soil erosion, among other environmental issues. According to the report, sand and gravel resources are the second-largest resource extracted and traded by volume after water. With sand harvesting regulated differently around the world, important regions for biodiversity and ecosystems are made more vulnerable by challenges in the local implementation of these regulations. A growing trend of unsustainable and illegal sand harvesting in semi-arid rivers makes this a sustainability challenge with a display of the various harvesting impacts on riverbeds and reduction in agricultural productivity and loss of livelihoods. Sand harvesting has also brought a myriad of social problems in Makueni including deaths resulting from conflicts, increased school dropout rates among the youth, deteriorating security and drug and substance abuse due to increased disposable income available to young men and women.

Trade in quality river sand is a lucrative business. It is a multimillion shilling enterprise largely controlled by ruthless, shadowy cartels. However, while these cartels and their associates are smiling all the way to the bank, residents of Makueni County who depend on the rivers for

domestic water, irrigation and livestock use, are left destitute. Very little income earned from the sand business is ploughed back to the local area for development. As a consequence, while the urban areas rise with gigantic buildings, rural areas are left with gulleys of empty holes of barren land (Gavriletea, M., 2017. To understand the environmental policy on sand harvesting and its effect to the sustainability of rivers in Makueni County, the study used four questions to guide the research: (1) what are the environmental policy frameworks that govern sand harvesting in Kenya? (2) Why do people harvest sand in Makueni County? (3) What should be done to ensure rivers are protected?

THEORETICAL FRAMEWORK

This study was guided by the theory of environmentally responsible behavior (ERB) and model of human interaction with the environment.

The Theory of Environmentally Responsible Behaviour

The ERB theory was proposed by Hines, Hungerford, and Tomera (Hines et al., 1987). The model argues that possessing an intention of acting is a major factor influencing ERB. The Model of Responsible Environmental Behaviour indicates that the following variables: intention to act, locus of control (an internalized sense of personal control over the events in one's own life), attitudes, sense of personal responsibility, and knowledge suggested whether a person would adopt a behaviour or not.

This model considers the major variables that play a part in the individual process of ERB adoption. According to the model, the internal control centre has a very considerable impact on the intention of acting, which determines an individual's ERB substantially. This model also highlights the existence of a relationship between the control centre, attitudes of individuals and their intention to act. The authors asserted that the control centre directly affects an individual's attitudes which can lead to an improved intention of acting and improved behaviour. Thus, the theory concentrates more on existing interactions between parameters that influence a person's behaviour than on the singular impact of a single variable.

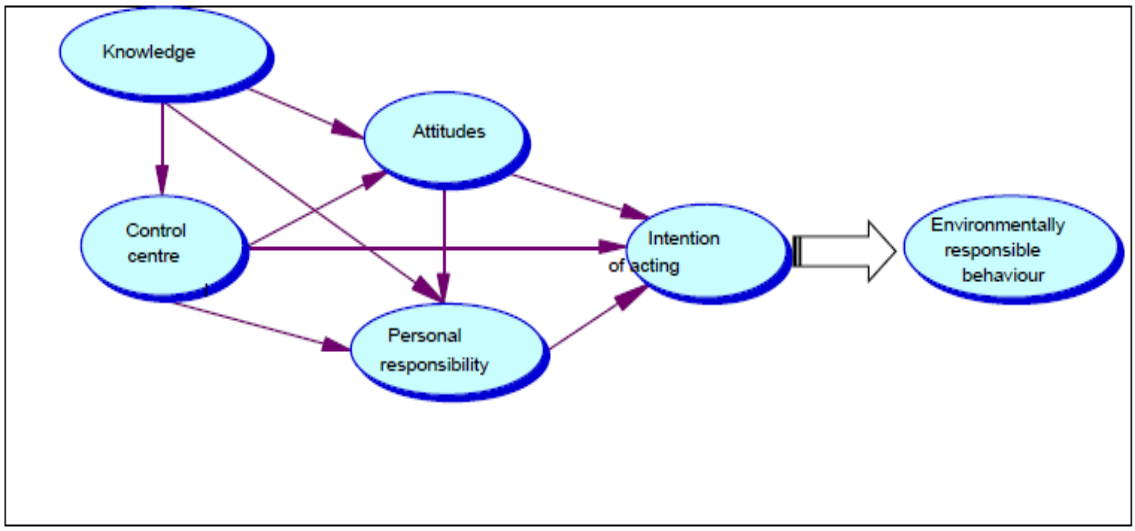

Figure 1: Theory of Environmentally Responsible Behaviour (ERB) Source: (Peggy & Korsching, 1996)

From Figure 1, knowledge alone is grossly insufficient to act responsibly towards the environment, while some individuals' knowledge on the environment and its regulations could prompt them to have a good attitude which could translate to good intentions to act, other individuals may go through the internal and external control, such as being influenced by the actions of others or holding strongly to a belief to act rightly despite the actions of others towards the environment. Although, separate constructs of attitudes, control center and intention of acting may not be enough for creating an intention to act, united under one overarching concept they become a base on which predispositions for pro-environmental behaviour are formed.

Relevance of ERB to the study

The theory was applicable in the sand harvesting management processes in Makueni County Government. Although there are existing laws and policies, there is no single element responsible for the current situation. That is, we have laws and policies in place that regulate harvesting of sand within the Makueni County rivers. However, the inhabitants are still involved in the illegal harvesting of sand. This happens during the odd hours or when the law enforcement agencies are not available or as a result of corruption amongst the inhabitants and law enforcers. Others practice this illegal sand harvesting because they see others doing it, while others do it because they believe it is the right thing to do. Thus, this theory/model described, explained, and offered control/regulatory aspects in the study problem, that is, investigated the status of the policies around conservation and management of sand harvesting in Makueni County.

Model of Human Interaction with the Environment

The model of human interaction with the environment was proposed by Hammond in 1995 (Hammond, 1999). This model describes four interactions between human activity and the environment. These are: source, sink, life support, and impact on human welfare. Hammond noted that the environment as a source, people derive minerals, energy, food, fibers, and other natural resources of use in economic activity, thus potentially depleting these resources or degrading the biological systems (such as soils, sand) on which their continued production depends.

Hammond further argued that natural resources are transformed by industrial activity into products (such as pesticides) and energy services that are used or disseminated and ultimately discarded or dissipated, thus creating pollution and wastes that (unless recycled) flow back into the environment. This can result into erosion or other environmental catastrophes. This is what he referred to as sink. The earth's ecosystems, especially unmanaged ecosystems, provide essential life-support services, ranging from the breakdown of organic wastes to nutrient recycling to oxygen production to the maintenance of bio-diversity. As human activity expands and degrades or encroaches upon ecosystems, it can reduce the environment's ability to provide such services. This is what Hammond described as life support. Further, polluted air, water, and contaminated food affect human health and welfare directly. This Hammond termed as impact on human welfare.

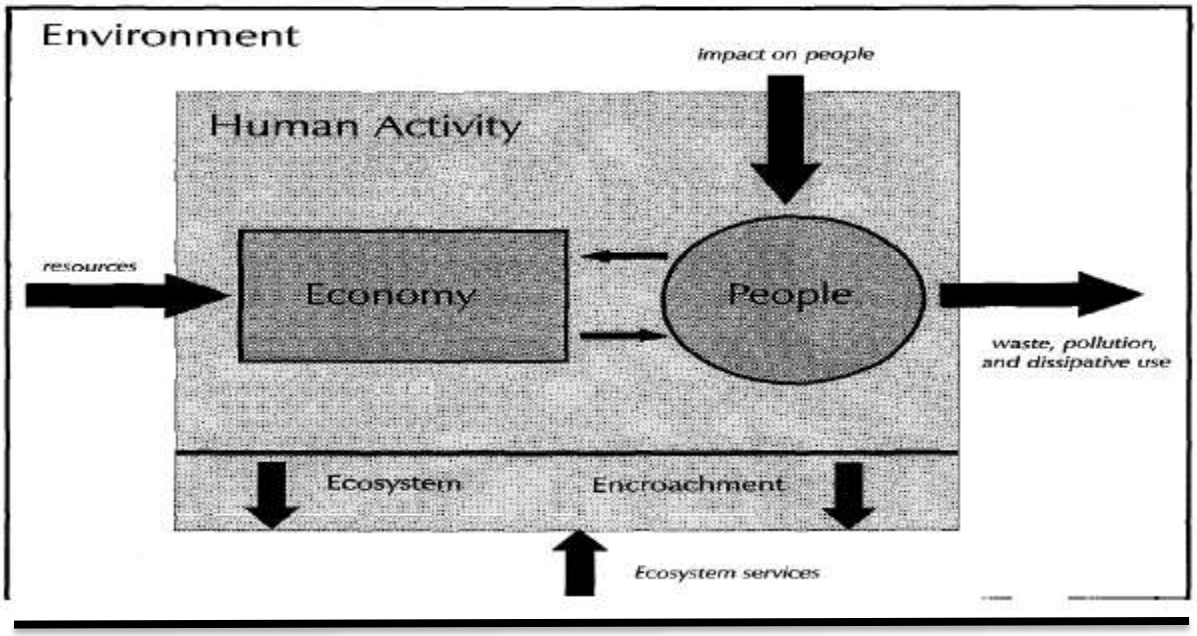

Figure 2: Model of Human Interaction with the Environment (Stern, 1999)

This model expressed how the human activities bear imprints on the environment. While this model concerns itself with the entirety of human activities, knowledge of interacting variables in the model enhances understanding of possible outcomes for different behaviours within the environment.

Relevance of ERB to the study

Sand as a natural resource is a source of livelihoods amongst those who cohabit in its periphery. It is an economic activity which in turn acts as a source of basic needs to the inhabitants of Makueni County. This occurs in the event that those who own this commodity trade with it. In exchange they earn money which supports their day – to – day activities such as buying food, paying bills etc. The implication of sand harvesting as an economic activity if not well managed and conserved destroys or impinges upon ecosystems (causing soil erosion / river erosions) and it can reduce the environments capability in producing such services. Therefore, this model described and explained the effects of the study problem.

METHODOLOGY

The study adopted interpretivist philosophical paradigm. An interpretive research paradigm is founded on the need to build a theory based on the provided data set, and hence make sense of the patterns in the data set (Horrigan-Kelly, Millar, & Dowling, 2016). Interpretive philosophy includes the use of what is known to construct theories on the provided subject matter (Yanow, 2007). The principles of interpretive philosophy do not define social reality within singularity and objectivism. In its place, it recognizes the importance of human interaction with the events in social reality, and the social historic context. Interpretive philosophy, therefore, provides a platform to reconcile the subjective encounters of the conservation and management of natural resources policies on sand harvesting in Makueni County and the interpretations of these experiences. Thus, for the present study, an interpretivist research philosophy was used as a guide for collecting and analysing primary qualitative data regarding the perceptions, beliefs and lived experiences of the people Makueni County on conservation and management of natural resources policies in respect to sand harvesting.

A qualitative research approach was employed in this study. According to Mohajan (2018), qualitative research involves collection and analysis of non-numerical data from first-hand observation, interviews, focus groups, recordings and participant observations in order to generate new knowledge about the phenomenon of interest. Specific to the present study, a qualitative methodological framework was adopted in order to collect and analyse primary non-numerical data describing the lived experiences, perceptions and beliefs of the people of Makueni County in relation to conservation and management of natural resources policies.

The study employed an exploratory research design. According to Swedberg (2020) an exploratory research design is one developed in areas without prior accumulative literature on a specific topic hence further probing for understanding is required. Explorative studies majorly use qualitative data and qualitative processes in achieving their goal. Swedberg (2020) noted that the use of qualitative data subjects the research to different interpretations, as qualitative information is not absolute. The use of small samples and subjective data sets results in a limitation to the effectiveness generalization of the research findings. Moreover, it limits the research application, since their inconclusive nature reduces the practicality of their use in decision making.

The target population for this study was inhabitants of Makueni County. It is argued that all the primary research designs, including qualitative, quantitative or mixed-methods approach, that integrates humans as data sources is required to delineate their specific population, so as to provide a framework for assessing eligibility of participation (Gentles et al., 2015; Palinkas et al., 2015). Therefore, a clearly defined study population helps in assuring overall validity of the study results as the generated outcomes can be easily generalised to the members of the targeted population.

A purposive sampling technique was adopted in selection and recruitment of members of the outlined population for the research study. According to Ghaljaie, Naderifar and Goli (2017) and Palinkas et al. (2015), purposive sampling is often used for qualitative research in determining a sample that best provides the required information. Through this sampling design, members of the population who meet the predetermined criterion were the ones sampled out for the research (Gentles et al., 2015; Ghaljaie, Naderifar and Goli, 2017).

The researcher used phenomenological research method as a data collection strategy. A phenomenological research according to Creswell and Poth (2018), describes the meaning of the lived experiences of individuals about a concept or phenomenon. This approach suited the study because the research focused on the lived experiences of the inhabitants of Makueni County in

relation to conservation and management of natural resources and sand harvesting. Daymon and Holloway (2010) posit that one of the strengths of phenomenology is that it helps the researcher to perceive the phenomena as the research participant will.

The data collection process in this study was executed through an in-depth interview and Focus Group Discussions (FGDs). Consistent with the explanations by Deterding and Waters (2021) and Zhang and Guttormsen (2016), in-depth interviewing is qualitative and entails intensively questioning the sampled persons with the intention of unearthing their beliefs, feelings, lived experience, and perspectives about the research phenomenon. According to Fritz and Vandermause (2018), in-depth interviews are appropriate in a situation where the researcher wishes to obtain detailed information about the participants' thoughts and behaviours or when performing an explorative study about an issue that had not been extensively explored before.

Thematic analysis technique was used to analyse data. Castleberry and Nolen (2018) and Clarke and Braun (2015) described thematic analysis as a technique for qualitative data which emphasises on identification, scrutiny, and interpretation patterns of meaning within the collected data. Even though Jackson and Bazeley (2019) noted that researchers may use a manual approach to conduct thematic analysis of data, Zamawe (2015) claimed that such approach may not lead to the generation of more precise and comprehensive themes from the qualitative data especially when there is a large volume of data to be analysed. Particular to this study, the use of in-depth interview led to the collection of large volumes of data hence a manual thematic approach was not used.

FINDINGS AND DISCUSSION

What are the Environmental, Institutional Policy Frameworks that Govern Sand Harvesting in Kenya?

Kenya has diverse legal and institutional policies that govern protection and sustainable protection of natural resources. However, some of the statutes overlap making their implementation complicated. Insufficient and conclusive policy and institutional framework for sand harvesting industry in Kenya has resulted to multifaceted conditions, which directly or indirectly affect the overall operations. Some of the policies that are directly govern sand harvesting are: National Sand Harvesting Guidelines, 2007; EMCA, 1999; EIA Regulations 2003; NEMA and WARMA. Alongside the Kenyan legislative framework, other international legislative frameworks on sand harvesting were reviewed and incorporated in suggesting the best way forward for sustainable sand harvesting. While there are other Acts that seem to govern how sand should be harvested in rivers, the incongruence makes the Acts vulnerable to misuse. People can escape arraignments in court because there has not been revision of the policies to be at pace with the changing sand harvesting dynamics. This resonates with xxx research which observed the gaps in policy framework governing sand harvesting in Kenya.

Laws, Policies and Regulations on Sand Harvesting

SDG-14 and SDG-15

Unregulated sand harvesting has been documented in 70 countries across the globe, with associated conflicts related to ecological destruction, livelihood disruption and labour rights violations. According to UNEP report (2019), sand battles have reportedly killed hundreds in recent years, including local citizens, police officers and government officials. In fact, nearly half of the United Nations' Sustainable Development Goals (SDGs) are compromised because of the large-scale exploitation of natural resources, which could help drive economic development more

equitably in poorer nations if their extraction was managed better. The two areas highly affected by this exploitation were SDG 14 and SDG 15 which stipulate:

SDG 14: *Conserve and Sustainably Use the Oceans, Seas and Marine Resources for Sustainable Development*

SDG 15: *Protect, Restore and Promote Sustainable Use of Terrestrial Ecosystems, Sustainably Manage Forests, Combat Desertification, and Halt and Reverse Land Degradation and Halt Biodiversity Loss*

National Sand Harvesting Guidelines, 2007

In Kenya, national sand harvesting guidelines stand out as the most spelt out regulations towards sand harvesting. There are touches by other legislations, some in contradiction. The sand harvesting guidelines have covered multifaceted directives on sand harvesting in Kenya; which include environmental and social considerations. The accomplishment of these guidelines is still very weak, considering the prevailing indicators. Wrecked sceneries, land degradation and environmental degradation are widespread conditions in sand mining areas, suggesting failures to protection of resources.

According to the environmental considerations of the sand harvesting policy guidelines, a technical sand harvesting committee should be in place in sand mining areas, which will ensure that the following stipulations are adhered to: Construction of sand dams/gabions in designated sand harvesting sites, which if implemented would go a long way in land conservation and prevention of soil erosion; 200m apart for where more than one gabion is constructed; Use of designate access roads by lorries transporting sand; Rehabilitation of sand harvesting sites by the Riparian Resource Management Association, County Council and approved dealers; Restriction of sand harvesting from the river banks, to curb loss of river courses, widening of rivers, increased evaporation; Carrying out of an EIA prior to sand harvesting

There is a large margin of variance in the achievement of those environmental considerations. In his paper, Kibwana (2018) urged Makueni residents to adopt a stewardship approach towards protecting the sand resource. While the County Acts and regulations are in place, there seem to be sustained infringement. One question the researcher may ask: Are these guidelines satisfactory? How do sand harvesters, ensure the environment is safeguarded and enhanced? How should they rehabilitate the deteriorated sand harvesting environments?

The social guidelines of the same Policy principally consider the social welfare of the people working in the sand industry. They however remain blanket policies, with weak implementation consideration. The policy is silent on implementation procedures. The social considerations of the policy guidelines include: Sand loaders to be above 18 years of age; Approved sand dealers to pay a negotiated and agreed wage to sand loaders; Loaders to organize themselves into recognized groups with clearly operational structures for their self-regulation; Approved sand dealers encouraged to support local community projects in consultation with the Riparian Resource Management Association (Ministry of Environment and Mineral Resources, 2010).

The Constitution of Kenya, 2010

The Constitution of Kenya advocates for sustainable and productive management of land resources, as well as sound conservation and protection of ecologically sensitive areas. The public is encouraged to participate in the management, protection and conservation of the environment, genetic resources and biological diversity. The state is expected to establish systems of

environmental impact assessment, environmental audit and monitoring of the environment; and eliminate processes and activities that are likely to endanger the environment. Thus, it is in the public interest for the government of Kenya to ensure that there is policy framework in place to guide in natural resources utilization, and protection of the environment.

Environmental Management and Co-ordination Act (EMCA) & Environmental Impact Assessment (EIA)

Among other priorities of natural resources by EMCA, the regulatory body is expected to propose guidelines for the integration of standards of environmental protection into development planning and management. For any person or business to be granted an approval to harvest sand an EIA for the river or part of the river must be done and an EIA License issued in accordance with EMCA and the Environmental Impact Assessment and Audit Regulations 2003. Consequent initial and annual Environmental Audits (EAs) must be undertaken for such approvals granted after the EIA to be renewed every subsequent year. It was observed that while these two Acts were in full force, engineers continued building, meaning sand was in adequate supply. These correlates Mutiso (2014).) Observation that the Acts seems to be contravened.

National Environmental Management Authority (NEMA)

EIA in sand harvesting areas as required under section 58 and the second schedule of EMCA and granting of such approvals as may be necessary or appropriate EIAs have been conducted as required under section 42(1) of EMCA. Issuing guidelines in consultation with relevant Lead Agencies for the management of the environment in lakes and rivers as required under section 42(4) of EMCA. To this effect, the National Sand Harvesting Guidelines have been issued and rolled out to guide environmental management in sand harvesting sites through public/social effective social organization and environmentally sound sand harvesting practices. However, as proven in ERB theory, these guidelines are not enforceable in the current state (Peggy & Korsching, 1996).

Makueni County Sand Conservation and Utilization Act (2015)

This is an Act that was launched by the 2014 task force, 'Makueni County Sand Conservation and Utilization Authority (MCSCUA)'. The task force's achieved its mandate of: Establishing Makueni County Sand conservation and Utilization Act and to manage litigation of crimes related to sand harvesting within Makueni County.

Why do people harvest sand?

The research findings established that sand harvesting activities have been increasing over time. After a river source has been mined, the sand barons and the local communities have no ready use of that area – the gulley is abandoned causing immerse damage to the ecosystem. The findings support studies by Fox (1996) who found that sand harvesting has historically resulted in long-term changes to biodiversity in Australia, China and Singapore. The study area is at close proximity of Machakos and Nairobi Counties where sand is increasingly in high demand for construction and other industrial development. The sand harvesting activities are bound to continue destroying rivers and the socio-economic lives of local communities. This study established that other sand harvesting-related infrastructure developments like roads and bridges also attributed to mechanical destruction of vegetation in the area. These kinds of infrastructural developments separate man at the centre of sustainable environment hence rendering man anti-anthropocentric and stripping human beings the privilege of environmental stewardship.

Since the sand mines are located in rivers and the permeability of the material in the floors and walls increases their water retention capabilities causing filling of the mines with water. The presence of water in the mines attracts concentrations of livestock in search of water around the mines. The populations of livestock overgraze the sand mining areas, a process that leads to plant species depletion. This is in agreement with studies by De Leeuw et al., (2001) and Stoddart et al., (1975) who observe that livestock species require drinking water either every day or every other day degrade areas surrounding

To establish the motivation for people to choose sand harvesting as an economic resource, the respondents were asked to indicate the extent to which sand harvesting led to economic prosperity. The study found out that 70% of the respondents indicated that sand harvesting resulted to drying of rivers which in turn led to drought and lack of water for domestic use, animals and irrigation, all of which resulted to poor economic outcomes. The findings further revealed that that 50% of the respondents thought that sand harvesting led to non-attendance to school by children which led to another problem – teenage school dropout and that became another major problem altogether. Other reasons which were given included: lack of job opportunities as a reason for sand harvesting; availability of buyers (sand barons); These findings are supported by the World Bank studies on natural resource misuse and poverty which found out that people in fragile and resource plenty environments are more than twice as likely to deplete their own resources compared to those in other developing countries, more than three times as likely to be unable to send their children to school, twice as likely to see their children die before the age of five, and more than twice as likely to lack clean water. Half of all children deaths occur in conflict affected areas (Muralikrishna, I. V., & Manickam, V. (2017).

From interview with sand harvesters it was established that the economic lifestyle of many sand harvesters come to a standstill whenever a river was depleted of sand. A sand harvester complained that:

> *Whenever sand gets finished in one river, many sand harvesters are affected. Many are forced to go without a source of income until the sand barons identify a new location to harvest sand. Sometimes their families go without food and they are compelled to live at a small budget to sustain themselves (Focus Group Discussion with Sand brokers at Mukaa on 4th February, 2021).*

Mckinlay (2004:220), commenting on the need for the youth to have jobs so that to avoid soaring of crime rate noted that:

> *Unemployment brings a raft of negative features, with the potential to lead to criminal activities: loss of status, boredom, alienation from the community, and the erosion of social values, and, loss of income. These factors all contribute to erosion of the values and norms of a well-functioning community. Very often dysfunctional families lack support structures. It becomes attractive for people of all ages to be lured into criminal activities (Mckinlay, 2004:220).*

What should be done to ensure protection of rivers?

Small scale sand harvesting comprises social, environment and economic issues and any strategy to improve the livelihood of those engaged in it must be cross-sectoral. The sustainable livelihood approach is one such strategy. It is an approach to poverty reduction, which focuses on a community's assets and strengths and their ability to access and manage. This approach focuses on development that meets the needs of the people without compromising their future generations (Brundtland, 1987).

The unregulated nature of sand mining coupled with the low Socio-economic Status (SES) of the Makueni residents has resulted to neglect of environmental concerns in the sand harvesting industry. The relationship between poverty and sand harvesting in the study area could be described as poverty trap mainly driven by the economic crisis, growing poverty and unemployment levels. The major worry is how to make an extra shilling from the sand harvesting that makes the phenomenon of the 'tragedy of the common' to become very predominant. The first sand harvesters were generally able to achieve a reasonable livelihood, but subsequent increases in the number of people joining the cartels saw a skewed balance between demand and supply. This low income coupled with a lack of investment opportunities in sand harvesting technology and skills result in inadequate and inappropriate techniques being used – that is why there are sand barons as the 'owners' of the industry, who are not necessary in the sand harvesting daily business, followed by the cartels who compete do dominate the area of study. This in turn causes extensive damage to the environment including water contamination, siltation and destruction of the landscape. Inefficient sand harvesting techniques exposes the rivers and the surrounding land to destruction hence low productivity of agriculture. Issues of abandoned mines, which are eroded every time it rains leaving a deep dungeon presents risks like drowning, and falls. Active sand mines pose a serious environmental threat as it is a gulley in waiting as soon as the resource is depleted by the sand harvesters.

Commitment to sustainable development requires integration of environmental policies and development strategies so as to satisfy current and future human needs, improve the quality of life and protect natural resources. Although MCSCUA provides for sustainable harvesting of sand limited to domestic use only, this clause was not taken into consideration under the current NEMA and EMCA Acts since sand harvesting was not considered as an economic activity at the time. While EMCA (1999) requires that mined land be restored to approximately its original status, nothing much has been done in the study area, due to compliance problems of the industry. However, (Hourdequin, 2015) observes that restoration of mining disturbance is essentially impossible no matter how much money is spent in the rehabilitation of a river. Rehabilitation of Makueni rivers therefore involve a great deal of establishment of stable and self-sustaining ecosystem that will ultimately lead to a productive and suitable ecosystem that will replace the pre-mined rivers and achieve the desired post-mining use. This has programme is gradually picking through the facilitation of Africa Sand Dam Foundation (ASDF) which aims at erecting sand dams with an aim of restoring sand that would be eroded during rains given that all sand has been excavated from the rivers. This calls for concerted efforts from all stakeholders including the sand harvesters, Government land use planners, local communities and NGOs dealing with natural resources management in the area.

DISCUSSION

Makueni County enacted legislation to control sand harvesting. Makueni County Sand Conservation and Utilization Act, 2015 (MCSCUA) was met with a series of resistance from the local Municipal County Assembly (MCA) representatives. They felt threatened by the policy since most majority of the MCAs were the sand barons and cartels and it took the intervention of the President of Kenya to stop an overthrowing attempt of the sitting governor, Prof. Kibwana. At its formation, MCSCUA was mandated to undertake the following core functions: (a) Supervise and coordinate all matters relating to sand conservation and utilization in the County; (b) Promote the integration of sand related environmental consideration into development policies, plans, programmers and projects; (c) Undertake and co-ordinate research, investigation and surveys in the field of Sand Conservation and utilization, and collect, collate and disseminate findings; (d) Ensure rehabilitation of the sand harvested sites and other environmental damage associated with harvesting and transportation of sand within the County; (e) Oversee licensing and registration of all persons who wish to engage in any sand utilization activities. However, despite enactment of the Makueni County Sand Conservation and Utilization Act and establishment of MCSCUA, illegal mining of sand from rivers in the county has continued, with tens of lorries sighted along the Nairobi-Mombasa Road ferrying tonnes of wet river sand. Sand harvesters are either ignoring the laid down law or MCSCUA is ineffective. It is suspected that this non-compliance to policies is influenced by age-old corruption practices and use of threats and deprivation to manipulate the local community to submission and allow the storms of illegal sand harvesting to prevail.

The EMCA (2009) Act encompasses the Environmental Management and Coordination (Wetlands, River banks, Lake showers and Sea Shore Management) regulations. This policy is governed by objectives which include (a) to provide for the conservation and sustainable use of rivers and their resources in Kenya; (b) to promote the integration of sustainable use of resources in rivers into the local and national management of natural resources for socio-economic development; (c) to ensure the conservation of water catchments and the control of floods; (d) to ensure the sustainable use of rivers for ecological and aesthetic purposes for the common good o all citizens; (e) to ensure the protection of rivers as habitats for species of fauna and flora; (f) provide a framework for public participation in the management of rivers; (g) to enhance education research and related activities; and (h) to prevent and control pollution and siltation. The policy is guided by the principles of sustainable use of the rivers and that Environmental Impact Assessment (EIA) and environmental audits as required under the Act shall be mandatory for all activities likely to have an adverse impact on the rivers; there is also undertaking of measures essential to promoting respect for, preserve and maintain knowledge innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices. The Act also provides for sustainable use of rivers which should be integrated with the national and local land use plans to ensure sustainable use and management of the resources. The issue of public participation in the management of rivers and the polluter-pays principle is also factored in this act. All these obligations under these Regulations have been factored in the local policy, the Makueni County Sand Conservation and Utilization Act (2015). To ensure sustainability of rivers EIA & Audit under the EMCA Act must be conducted every year as per the EMCA Act. Reports from National Environment Management Authority (NEMA) show that industries continue to violate policies around waste disposal, harmful chemicals have been channeled to rivers to harm aquatic life thereon, the construction industry continue to build

skyscrapers while leaving dungeons of rivers with no compliance to Engineering Board of Kenya (EBK) protocol.

The study revealed that Makueni community members were more inclined into sand harvesting business because of its quick revenue returns. Feedback from the local residents affirmed their desire to continue trading in the business in spite of the looming catastrophe of a depleted environment. However, the residents acknowledged the lack of alternative economic resources and they were open to other sources of livelihood if they were made available. Proponents of the campaigns against sand harvesting wished to have increased and dynamic sand conservation projects to help curb the problem of sand harvesting. Residents expressed hopes of better rivers with the continued sand dams that were constructed in rivers that had been depleted of the sands.

While the researcher's focus was on the rivers of Makueni County, she was quick to notice that these sand harvesting activities had spread from Eastern Kenya to North-Eastern to Western and South Nyanza. With this in mind, it was important to come up with a uniform mitigation measures that would curb the illegal activities countrywide. The use of heavy earth-moving machineries would damage the marine ecosystem same way. The impact would be spread from loss of habitat for vegetation, invertebrates, fishes, turtles, to death extinction of bird species that reside near rivers and that would naturally culminate to another problem of decreased nature and wildlife tourism. NEMA must employ a cost-benefit analysis approach to determining the external costs of biodiversity loss from such development projects and impose a cost on the activities that cause adverse impacts to biodiversity. There must be regular project monitoring and evaluations by both NEMA and the developers to ensure there is no deviation from the project plan and environmental conditions set.

Sand harvesting should be done in a way that limits environmental damage during exploitation and restores the land after mining operations are completed and that would mean operating within the premise of sustainable development.

CONCLUSION

The study established that sand in Makueni County rivers has influenced some socio- economic benefits associated to the activity which included; the provision of employment, generation of income and infrastructural development within the Makueni Metropolis. However, these factors have led to a surge in unsustainable and indiscriminative sand harvesting in the area leading to the depletion of rivers of the water catchment matter. The indiscriminate harvesting disregarded the benefits that may accrue from well-maintained rivers which could provide the residents and surrounding communities with water for their use.

To control Sand harvesting in Makueni County, the central government should support the local government to: map and compel sand harvesting companies and cartels to restore the rivers to stop further destruction of the river ecosystem. This being a tedious and a long-term process, the government will have discouraged them from engaging in the business; all the acts government sand harvesting activities must be repealed and improved to avoid further lapses. NEMA and EMCA acts must actively be involved in ensuring that no more sand harvesting in the region and any company found continuing with the business must be stripped of its operating licence.

ADVOCACY PLAN

As a mitigation plan towards addressing negative outcomes of sand harvesting that we have seen in the discussion, the researcher will implement a number of strategies by way of adopting an advocacy planning cycle: one (workshop & all stakeholders); two – explore alternative

construction technologies that do not use sand. Singapore has successfully adopted Ferrocement and Koto concepts of construction which uses very minimal sand or none. How about mabati houses that can be refurbished inside using a plywood? The researcher hopes that this thought-provoking ideas will contribute to the abolishment of sand harvesting in Makueni County. The researcher hopes that the Citizenship Responsible Behaviour will provoke all stakeholders in preparing the County towards the adoption of environmentally friendly construction alternatives as well as help the Government in achieving one of its Big Four agenda items of affordable housing and ecological balance.

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