

Utilising Science and Technology for Environmental Management in Kenya

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**UTILISING SCIENCE AND TECHNOLOGY FOR ENVIRONMENTAL
MANAGEMENT IN KENYA**

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Abstract

The paper advocates for the use of science and technology for environmental management in Kenya. It critically discusses environmental management tools in Kenya which include the law, ethics, Environmental Impact Assessment, market forces and institutions such as national courts and tribunals and the public while pointing out their shortcomings. The paper argues that environmental management tools in Kenya have not been fully effective in environmental protection and conservation as evidenced by several environmental concerns such as pollution and degradation. It presents a case for the enhancement of science and technology as an environmental management tool in Kenya in order to effectively achieve the right to a clean and healthy environment and promote sustainable development.

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TABLE OF CONTENTS

1. INTRODUCTION 4

2. ENVIRONMENTAL MANAGEMENT TOOLS IN KENYA 5

 a. Role of Law in Environmental Management 5

 b. Role of National Courts and Tribunals in Environmental Management 7

 c. Role of the Public in Environmental Management 9

 d. Fiscal Incentives..... 10

 e. Environmental Ethics 11

 f. Environmental Education 11

3. ROLE OF SCIENCE AND TECHNOLOGY IN ENVIRONMENTAL MANAGEMENT IN KENYA 12

 a. Industrial Waste Treatment..... 14

 b. Adoption of Green and Clean Technologies 16

 c. Climate Change Mitigation 17

4. CONCLUSION 18

REFERENCES..... 19

1. INTRODUCTION

The importance of the right to a clean and healthy environment cannot be overemphasized. It is an essential human right that has been equated to the right to life in Kenya.¹ Since it contains virtually all the ingredients necessary for human survival, the natural environment is often susceptible to human action such the use and exploitation of natural resources including water, minerals and energy. Some of these activities have resulted in environmental degradation threatening the right to a clean and healthy environment.

Environmental management is essential towards attainment of the right to a clean and healthy environment in Kenya. It regulates human interaction with the environment. Environmental management combines science, policy, and socioeconomic application in finding solutions to practical problems that people face in cohabitation with the environment, resource exploitation and waste production.² The Environmental Management and Co-Ordination Act (EMCA) defines environmental management to include the protection, conservation and sustainable use of the various elements or components of the environment.³

However, in Kenya, environmental management has often taken a human approach with little emphasis on the role of science and technology towards achieving this goal. The paper analyses environmental management tools in Kenya and points out the shortcomings in the human approach towards environmental management. It proposes an integrated approach towards environmental management in Kenya that fully recognises and incorporates the use of science and technology.

¹ See the case of *Peter K. Waweru v Republic*, Misc. Civil Application No. 118 of 2004, (2006) eKLR

² National Environment Commission, 'Environmental Management Tools and Techniques' available at https://www.undp.org/content/dam/bhutan/docs/Energy_environment/Env-publications/2011-NEC-Env%20Mgt%20Tools.pdf (accessed on 17/03/2020)

³ Environmental Management and Co-Ordination Act (EMCA), No. 8 of 1999, S 2, Government Printer, Nairobi

2. ENVIRONMENTAL MANAGEMENT TOOLS IN KENYA

a. Role of Law in Environmental Management

The Constitution of Kenya, 2010 enshrines the right to a clean and healthy environment.⁴ It further sets out certain obligations in respect of the environment.⁵ These include the requirement of the state to ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources; and to encourage public participation in the management, protection and conservation of the environment.⁶

In addition to the Constitution, environmental management in Kenya is also governed by various sectoral legislations.⁷ The *Environmental Management and Coordination Act* is the principal legal instrument for the management of the environment in Kenya.⁸ The Act also establishes an institutional framework for management of the environment in Kenya.⁹ It further sets out several measures aimed at protection and conservation of the environment and several environmental management tools such as Strategic Environmental Assessment, Environmental Impact Assessment, Environmental Audit and Monitoring and Environmental Quality Standards.¹⁰

⁴ Constitution of Kenya, 2010, Article 42: 'Every person has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and to have obligations relating to the environment fulfilled under Article 70.

⁵ Ibid, Article 69 (1)

⁶ Ibid

⁷ Environmental sectoral legislations in Kenya include the Environmental Management and Co-Ordinations Act, No. 8 of 1999, Wildlife Conservation and Management Act, No. 47 of 201, Forest Conservation and Management Act, No. 34 of 2016, Climate Change Act, No. 11 of 2016, Mining Act, No. 12 of 2016 and Water Act No. 43 of 2016. They govern various environmental sub sectors including water, forests and minerals.

⁸ Environmental Management and Co-Ordination Act (EMCA), No. 8 of 1999, Government Printer, Nairobi

⁹ Section 7 of the Act establishes the National Environment Management Authority whose object and purpose is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment.

¹⁰ EMCA, Parts V, V1, VII and VIII.

Utilising Science and Technology for Environmental Management in Kenya

Environmental management is also governed by a number of systems and standards. The ISO 14000 entails a number of standards developed by the International Organization for Standardization to help organizations take a proactive approach to managing environmental issues.¹¹ The ISO standards provide a framework through which governments and regulatory bodies can structure their environmental management tools to ensure alignment and consistency both nationally and internationally.¹² EMCA also establishes environmental quality standards aimed at protecting various sectors of the environment through placing limits on discharge and emissions. These include water quality standards, air quality standards, standards for waste and standards for noise.¹³

Despite law being an essential tool for environmental management in Kenya, it is clouded by certain weaknesses that hinder its efficacy towards this course. These weaknesses include complex institutional set ups, differing and overlapping mandates of state agencies tasked with environmental management and conflicting management and enforcement methods over similar resources.¹⁴ Further, there exist enforceability challenges as can be witnessed in aspects such as solid waste management.¹⁵

¹¹ Environmental Management: The ISO 14000 family of International Standards, available at https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/theiso14000family_2009.pdf(Accessed on 03/04/2020).

¹² Ibid

¹³ EMCA, Part VIII

¹⁴ Muigua. K., Wamukoya. D., & Kariuki. F., 'Natural Resources and Environmental Justice in Kenya' Glenwood Publishers Limited, 2015

¹⁵ Haregu Nigatu. T., An assessment of the evolution of Kenya's solid waste management policies and their implementation in Nairobi and Mombasa: analysis of policies and practices , *Environment and Urbanization*, Vol. 29, Issue 2, 2017

b. Role of National Courts and Tribunals in Environmental Management

Courts play an important role in environmental management in Kenya through the promotion and protection of environmental rights.¹⁶ The Constitution provides the framework for enforcement of environmental rights through an application to court.¹⁷ On such an application, a court may grant appropriate remedies including an order to prevent, stop or discontinue an act or omission that is harmful to the environment or provide compensation to a victim of violation of the right to a clean and healthy environment.¹⁸

Courts and tribunals including the Environment and Land Court¹⁹ and the National Environment Tribunal²⁰ have facilitated this role through developing environmental jurisprudence and promoting the principles of sustainable development. In *Peter K. Waweru v Republic*²¹, the court while upholding the principles of sustainable development equated the right to a clean and healthy environment with the right to life and held that:

'We have added the dictionary meaning of life which gives life a wider meaning including its attachment to the environment. Thus a development that threatens life is not sustainable and

¹⁶ Muigua. K., 'The Role of Courts in Safeguarding Environmental Rights in Kenya: A Critical Appraisal' available at <http://kmco.co.ke/wp-content/uploads/2019/01/The-Role-of-Courts-in-Safeguarding-Environmental-Rights-in-Kenya-A-Critical-Appraisal-Kariuki-Muigua-17th-January-2019-1.pdf> (accessed on 19/03/2020)

¹⁷ Constitution of Kenya, 2010, Article 70 provides that if a person alleges that the right to a clean and healthy environment recognised and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.

¹⁸ Ibid, Article 70 (2)

¹⁹ The Environment and Land Court is established under section 4 of the Environment and Land Court Act, No. 19 of 2011. In the context of environment management, the Court hears and determines disputes relating to environmental planning and protection, climate issues, mining, minerals and natural resources.

²⁰ The National Environment Tribunal is established under section 125 of the Environmental Management and Co-Ordination Act, No. 8 of 1999. Its jurisdiction entails hearing appeals in relation to inter alia grant of a licence or permit or refusal to grant a licence or permit.

²¹ *Peter K. Waweru v Republic*, Misc. Civil Application No. 118 of 2004, (2006) eKLR

Utilising Science and Technology for Environmental Management in Kenya

ought to be halted. In environmental law life must have this expanded meaning as a matter of necessity.'

In *Save Lamu & 5 others v National Environmental Management Authority (NEMA) & Another*, the National Environment Tribunal while setting aside the decision by the National Environment Management Authority (NEMA) to issue an EIA Licence held as follows:

'The purpose of the Environment Impact Assessment (EIA) process is to assist a country in attaining sustainable development when commissioning projects. The United Nations has set Sustainable Development Goals (SDGs), which are an urgent call for action by all countries recognizing that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests. (emphasis added)'²²

This demonstrates that national courts and tribunals are essential in environmental management in Kenya through development of environmental jurisprudence and promoting the principles of sustainable development.²³ However, this role can be hindered by factors such as case load, costs of litigation, delays and procedural technicalities which continue to affect the judicial system in Kenya.²⁴

²² *Save Lamu & 5 others v National Environmental Management Authority (NEMA) & Another*, Tribunal Appeal No. NET 196 of 2016, (2019) eKLR

²³ Muigua. K., 'The Role of Courts in Safeguarding Environmental Rights in Kenya: A Critical Appraisal' Op Cit

²⁴ Ibid

c. Role of the Public in Environmental Management

The Rio Declaration provides that environmental issues are best handled with the participation of all concerned citizens, at the relevant level.²⁵ In Kenya, public participation is a key aspect of environmental and natural resources management.²⁶ It allows persons who are likely to be affected by environmental laws, policies and projects within their localities to express their views for consideration in implementation of such laws, policies and projects.²⁷ Public participation has been enshrined as one of the national values and principles under the Constitution.²⁸ The Constitution further obligates the state to encourage public participation in the management, protection and conservation of the environment.²⁹

The role of public participation environmental management was succinctly captured in *Patrick Musimba v National Land Commission & 4 others*, where it was held that:

'We have no doubt that the State under Article 69 of the Constitution is enjoined to ensure sustainable development: see also the Preamble to the Constitution. The State is also to ensure that every person has a right to a clean and healthy environment. However physical development must also be allowed to foster to ensure that the other guaranteed rights and freedoms are also achieved. Such physical development must however be undertaken within a constitutional and statutory framework to ensure that the environment thrives and survives. It is for such reason that the Constitution provides for public participation in the management, protection and conservation of the environment (emphasis added).'

Public participation is an essential tool of environmental management in Kenya which ensures that the views of the public are taken into account in environmental decision making. However, public participation in environmental decision making raises certain

²⁵ Rio Declaration on Environment and Development, 1992, A/CONF.151/26 (Vol. I), Principle 10

²⁶ Muigua. K., Wamukoya. D., & Kariuki. F., 'Natural Resources and Environmental Justice in Kenya' Glenwood Publishers Limited, 2015.

²⁷ Ibid

²⁸ Constitution of Kenya, 2010, Article 10 (2) (a)

²⁹ Ibid, Article 69 (1) (d)

concerns such as the quality and extent of participation and the need to ensure that it is not enough for people to participate but there is need for them to be able to appreciate the real implications of any decision being made.³⁰ Without this, public participation is reduced to a matter of formality without any real benefit or achieving the desired end.³¹

d. Fiscal Incentives

Incentives are forms of rewards extended to business players as a way of encouraging them to adopt measures that help in preserving the environment while discarding or avoiding those that contribute to the degradation of the environment.³² They take several forms including tax/fiscal measures.³³ EMCA provides for tax and other fiscal incentives, disincentives or fees as may be proposed by the government to induce or promote the proper management of the environment and natural resources or the prevention or abatement of environmental degradation.³⁴ Under the Act, such tax and fiscal incentives, disincentives or fees may include customs and excise waiver in respect of imported capital goods which prevent or substantially reduce environmental degradation caused by an undertaking and tax rebates to industries or other establishments that invest in plants, equipment and machinery for pollution control, recycling of wastes, water harvesting and conservation, prevention of floods and for using other energy resources as substitutes for hydrocarbons.³⁵

However, one of the shortcomings of incentive based mechanisms is that they do not fit every problem hence not widely used in environmental protection.³⁶ Further, there may

³⁰ Muigua. K., Towards Meaningful Public Participation in Natural Resource Management in Kenya, available at <http://kmco.co.ke/wp-content/uploads/2018/08/TOWARDS-MEANINGFUL-PUBLIC-PARTICIPATION-IN-NATURAL-RESOURCE-MANAGEMENT-IN-KENYA.pdf> (accessed on 01/04/2020)

³¹ Ibid

³² Muigua. K., Wamukoya. D., & Kariuki.F., Natural Resources and Environmental Justice in Kenya, Glenwood Publishers, 2015

³³ Ibid

³⁴ EMCA, S 57 (1)

³⁵ Ibid, S 57 (2) (b)

³⁶ Andre. F., Firms and the Environment: Ethics or Incentives? *Corporate Social Responsibility Series*, (Ashgate Publishing Ltd., 2005)

be bureaucratic obstacles to the successful use of incentives such as difficulties of the economic calculations involved.³⁷

e. Environmental Ethics

It has been asserted that economic and judicial methods cannot solve environmental challenges on their own with a call of appeal to human beings' limitless internal ethical resources in the quest for environmental conservation.³⁸ Environmental ethics is aimed at providing ethical justification and moral motivation for the cause of global environmental protection.³⁹ This calls for adoption of an appropriate attitude towards nature and establishment of an ethical relationship between human beings and nature in order to foster environmental conservation. However, environmental ethics is yet to be fully embraced in Kenya as evidenced by numerous cases of environmental pollution perpetrated by human beings.

f. Environmental Education

Environmental degradation has been attributed to among other factors, poverty and low levels of education.⁴⁰ Provision of education is therefore a crucial step towards elimination of bad environmental practices.⁴¹ Education has the ability to empower people and give them alternative means of making a living as opposed to relying on the environment for their sustainability.⁴² Further education has the ability to enhance sustainable development by improving the capacity of citizens to address environmental and developmental issues.⁴³ If empowered through education, citizens are able to make environmentally sound decisions in matters relating to exploitation of

³⁷ Ibid

³⁸ Yang, T., Towards an Egalitarian Global Environmental Ethics, *Environmental Ethics and International Policy*, available at <http://publishing.unesco.org/chapters/978-92-3-104039-9.pdf> (accessed on 03/04/2020)

³⁹ Ibid

⁴⁰ See UNESCO, 'Educating for a Sustainable Future: A Transdisciplinary Vision for Concerted Action' available at <https://unesdoc.unesco.org/ark:/48223/pf0000110686> (accessed on 03/04/2020)

⁴¹ Ibid

⁴² Muigua. K., *Nurturing Our Environment for Sustainable Development*, Glenwood Publishers Limited, 2016

⁴³ Ibid

natural resources, Environmental Impact Assessment (EIA) and those having a bearing on the environment.⁴⁴

3. ROLE OF SCIENCE AND TECHNOLOGY IN ENVIRONMENTAL MANAGEMENT IN KENYA

It has been argued that science and technology can provide effective solutions to most, if not all, environmental problems facing the world.⁴⁵ In the context of environmental management, environmental science studies the mechanisms and processes underlying our interactions with the natural environment whereas environmental technology allows application of such knowledge through actions geared towards environmental protection and conservation.⁴⁶ Technology not only refers to machines and equipment, but also includes the knowledge, abilities, skills, processes and systems necessary to facilitate environmental conservation and protection.⁴⁷ To this extent, technology has been classified as *soft technology* which entails information, training, research and capacity building and *hard technology* comprising of equipment.⁴⁸

Science and technology have resulted in many environmental problems but can also be key to addressing environmental concerns such climate change, waste management and environmental degradation.⁴⁹ It has been described as a double edged sword capable of both doing and undoing environmental damage.⁵⁰ Most environmental challenges such

⁴⁴ Ibid

⁴⁵ Huesemann. M.H., 'Can Pollution Problems Be Effectively Solved by Environmental Science and Technology? An Analysis of Critical Limitations, *Ecological Economics*, Volume 37, Issue 2, May 2001, pg 271-287

⁴⁶ Voulvoulis.N., & Burgman.M.A., The Contrasting Roles of Science and Technology in Environmental Challenges, *Critical Reviews in Environmental Science and Technology*, Volume 49, 2019, issue 12

⁴⁷ Srinivas. H., 'Introduction: Technology and Environment' available at <http://www.gdrc.org/techtran/introduction.html> (accessed on 18/03/2020)

⁴⁸ Ibid

⁴⁹ Nichols. M.R., 'How Technology Can Save the Environment' available at <https://born2invest.com/articles/technology-save-environment/> (accessed on 03/04/2020)

⁵⁰ Hsiang Kung. W., The Role of Science in Environmental Protection: Is the Development of Environmental Law Toward More Protective and Productive Way, or Distorted to Inequality, Through the Involvement of Science?, available at

as global warming and climate change can be attributed to technological innovations since they are majorly caused by industrial pollution and fuel emissions from motor vehicles.⁵¹ Addressing these environmental concerns requires the input of science and technology through measures such as reducing greenhouse gases, conserving biological diversity, providing clean energy and expanding the adoption of green technologies for climate change mitigation⁵²

Environmental management and decision making in Kenya is governed by laws, regulations, and policies. Due to the shortcomings of such laws, regulations and policies, there is need for these processes to be informed by scientific evidence.⁵³ Indeed, science has the ability to remedy the shortcomings of laws and regulations through effective solutions tailor made to specific problems. The outbreak and spread of the Covid-19 pandemic is a clear example. Whereas countries have applied laws such as lock downs, curfews, quarantine and travel restrictions, spread of the virus still continues and the most effective solution to the pandemic would be through scientific knowledge and research to discover a cure and a viable vaccine.⁵⁴ In the context of environmental management, there is need to link law and science in order to ensure effective environmental management.⁵⁵

<https://poseidon01.ssrn.com/delivery.php?ID=893002127097024114071115075119005086117078019060066055110020095103024092069022098068013121004003017116060026103006068079097117116082071048061020026097093088117111003050062091116092001083026120014098122100070091110000102071109121123123124101104081026&EXT=pdf> (accessed on 01/04/2020)

⁵¹ Ibid

⁵² Juma. C., 'Exponential Innovation and Human Rights: Implications for Science and Technology Diplomacy', *Science, Technology and Globalization*, February, 2018

⁵³ Moore. J.W et al, Towards Linking Environmental Law and Science, available at <https://www.facetsjournal.com/doi/pdf/10.1139/facets-2017-0106> (accessed on 01/04/2020)

⁵⁴ Human Rights Dimension of Covid-19 Response, available at <https://www.hrw.org/news/2020/03/19/human-rights-dimensions-covid-19-response> (accessed on 03/04/2020)

⁵⁵ Ibid

In Kenya, the Constitution obligates the state to recognize the role of science and indigenous technologies in the development of the nation.⁵⁶ To this effect, strides have been made towards the use of science and technology in environmental management. The ban on the manufacture, importation, supply, distribution and use of plastic bags and the subsequent adoption of woven bags has helped to curb environmental pollution.⁵⁷ However, more needs to be done to integrate the use of science and technology in environmental management in Kenya. Adoption of cleaner technologies in such areas as transport, energy production and food production can be an effective preventive measure.⁵⁸ Scientific knowledge is also useful in helping the citizenry adopt healthy lifestyles for a better, cleaner and healthier environment. ⁵⁹Some of the measures that can be adopted towards integrating the use of science and technology in environmental management in Kenya include:

a. Industrial Waste Treatment

In Kenya, most of the waste discharged from industries is not treated before recycling or disposal.⁶⁰ This poses health risks and causes damage to the environment since such waste is often discharged into water sources.⁶¹ Consequently, the industries involved in pollution have found themselves at war with environment entities including the National Environment Management Authority.⁶² Some of the measures that have taken

⁵⁶ Constitution of Kenya, 2010, Article 11 (2) (b)

⁵⁷ National Environment Management Authority, 2 years on: Say no to plastic bags, available at http://www.nema.go.ke/index.php?option=com_content&view=article&id=296&catid=2&Itemid=451 (Accessed on 20/03/2020)

⁵⁸ Muigua.K., Reconceptualising the Right to a Clean and Healthy Environment in Kenya, available at <http://kmco.co.ke/wp-content/uploads/2018/08/RIGHT-TO-CLEAN-AND-HEALTHY-ENVIRONMENT-IN-KENYA.docx-7th-september-2015.pdf> (accessed on 04/04/2020)

⁵⁹ Ibid

⁶⁰ National Environment Management Authority, 'The National Solid Waste Management Strategy', available at <http://www.nema.go.ke/images/Docs/Media%20centre/Publication/National%20Solid%20Waste%20Management%20Strategy%20.pdf>, accessed on 28/03/2020.

⁶¹ Ibid

⁶² The National Assembly Departmental Committee on Environment and Natural Resources, Report on an Inquiry Into Complaints of Environmental Pollution, available at

by NEMA include closure of industries allegedly engaged in these acts.⁶³ However, with recent reports of industrial pollution of river sources such as the Nairobi River, questions still linger on the effectiveness of measures adopted in dealing with this challenge.⁶⁴

Industrial pollution is a global problem which is not alien to Kenya. Scientific measures that have been adopted to deal with industrial waste include use of materials such as zeolites, geopolymers, activated carbons and nanomaterials due to their characteristics such as ion exchange capacity, adsorption and photocatalytic action.⁶⁵ However, use of science and technology in industrial waste treatment has not been fully appreciated in Kenya. NEMA acknowledges that waste treatment technologies have not been fully embraced in the country which can be attributed to a number of factors such as lack of awareness and knowledge of such technologies; inadequate funding; limited technical competence and slow adoption of modern technological options.⁶⁶

There is need for the use of science and technology in industrial waste management in order to enhance environmental management and protection.

http://www.parliament.go.ke/sites/default/files/2019-09/LDK%20REPORT_compressed.pdf, accessed on 28/03/2020

⁶³ National Environment Management Authority (NEMA), Factories Closed, Owners Arrested for Polluting Environment, available at

http://www.nema.go.ke/index.php?option=com_content&view=article&id=298:factories-closed-owners-arrested-for-polluting-environment&catid=10:news-and-events&Itemid=454 (accessed on 06/04/2020)

⁶⁴ Kamau, J., How Nairobi River Lost Pollution Battle, *Daily Nation*, Monday, August 19, 2019

⁶⁵ De Luca, P et al, Industrial Waste Treatment by ETS-10 Ion Exchanger Material, available at <https://www.mdpi.com/1996-1944/11/11/2316> (accessed on 28/03/2020)

⁶⁶ National Environment Management Authority, 'The National Solid Waste Management Strategy' Op Cit

b. Adoption of Green and Clean Technologies

Green technology is an umbrella term that refers to the use of science and technology to create products and processes that are environmentally friendly for sustainable development.⁶⁷ Clean technology refers to products or services that improve operational performance while reducing costs, energy consumption, waste or negative effects on the environment.⁶⁸ These technologies can be used to protect the environment and in some instances repair damage done in the past. They provide the best eco-friendly option to ensure future sustainability.⁶⁹ Such technologies include recycling of waste and use of renewable sources of energy solar, wind and geothermal energy.⁷⁰

Kenya has made some significant strides towards the adoption of green and clean technologies especially in the area of renewable energy. The country has been ranked as the largest producer of renewable energy in Africa with 70% of its electricity generation coming from renewable sources such as geothermal, hydropower, wind and solar sources.⁷¹ The government through the National Environment Management Authority imposed a ban on plastic carrier bags which has led to the use of eco-friendly non-woven bags.⁷² Such measures are to be lauded since they offer significant promise in the country's endeavour towards green and clean technologies. There is however need for more measures towards this endeavour such as the adoption of agricultural methods

⁶⁷ Ali.M., Model of Green Technology Adaptation in Small and Medium -Sized Tannery Industry, *Journal of Engineering and Applied Sciences*, 12 (4), 2017

⁶⁸ Kenton. W., Green Tech, available at https://www.investopedia.com/terms/g/green_tech.asp (accessed on 29/03/2020)

⁶⁹ National Environment Management Authority (NEMA), Green Initiatives in Kenya, available at <http://nema.go.ke/images/Docs/Media%20centre/Brochures/Green%20Economy%20Booklet.pdf> (accessed on 29/03/2020)

⁷⁰ Ibid

⁷¹ Kenya News Agency, New Push on Green Technologies, available at <https://www.kenyanews.go.ke/new-push-on-green-technologies/>, accessed on 29/03/2020

⁷² National Environment Management Authority, Ban on Manufacture, Importation, Supply, Distribution and use of Plastic Carrier Bags in Kenya, available at http://www.nema.go.ke/index.php?option=com_content&view=article&id=296&catid=2&Itemid=451 (accessed on 29/03/2020)

and technologies that are eco-friendly as opposed to the polluting and dangerous chemicals.⁷³

c. Climate Change Mitigation

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as change of climate which is attributed directly or indirectly to human activities which alter the composition of the global atmosphere and which are in addition to natural climate variability observed over comparable time periods.⁷⁴ Climate change has become a global concern in the 21st century and has been a dominant subject in political and scientific discussions.⁷⁵ It is majorly caused by human activities that lead to atmospheric concentration of green-house gases such as burning of fossil fuels, deforestation and increase in carbon dioxide levels. In order to curb this problem, nations under the Paris Agreement have come together under a common cause to undertake ambitious measures aimed at combating climate change and adapting to its effects.⁷⁶ The Agreement is aimed at holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels in recognition that this would significantly reduce the risks and impacts of climate change.⁷⁷ The Agreement recognises the role of science in climate change mitigation and calls upon states to adopt a country-driven, gender-responsive, participatory and fully

⁷³ Muigua. K., *Nurturing Our Environment for Sustainable Development*, Glenwood Publishers Limited, 2016

⁷⁴ United Nations Framework Convention on Climate Change (UNFCCC), United Nations, 1992, available at <https://unfccc.int/resource/docs/convkp/conveng.pdf> (accessed on 30/03/2020)

⁷⁵ Owusu. P.A., & Asumadu-Sarkodie. S, *A Review of Renewable Energy Sources, Sustainability Issues and Climate Change Mitigation*, available at <https://www.tandfonline.com/doi/pdf/10.1080/23311916.2016.1167990?needAccess=true> (accessed on 30/03/2020)

⁷⁶ United Nations Framework Convention on Climate Change, Paris Agreement, 2015, available at http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf (accessed on 30/03/2020)

⁷⁷ Ibid, Article 2 (1) (a)

transparent approach guided by the *best available science* and, as appropriate, *traditional knowledge, knowledge of indigenous peoples and local knowledge systems* (emphasis added).⁷⁸

Kenya like the rest of the world is faced with the threat of climate change. The Kenya National Adaptation Plan acknowledges the role of science, technology and innovations matched to local needs and risks towards climate change mitigation.⁷⁹ It proposes thoughtful prioritisation of research funding and policy to encourage innovation that will grow Kenya's knowledge-based economy, building resilience through climate-compatible development whilst also encouraging the expansion of technology and expertise exports.⁸⁰ The country should be more proactive in adoption of technological and scientific measures aimed at curbing climate change such as the use of clean energy sources.

4. CONCLUSION

The right to a clean and healthy environment is a salient human right that has been equated to the right to life in Kenya. However, environmental challenges that continue to be witnessed in the country such as pollution, environmental degradation, deforestation and the threat of climate change necessitate the need for a more collaborated approach towards environmental protection and conservation in Kenya. The role of science and technology in environmental protection and conservation in Kenya has often been neglected with more emphasis being placed on legal and other approaches. With environmental concerns still being witnessed in Kenya, the shortcomings of these measures is evident. There is need for enhancement of the use of science and technology in environmental protection and conservation in Kenya in order

⁷⁸ Ibid, Article 7 (5)

⁷⁹ Ministry of Environment and Forestry, National Climate Change Action Plan 2018-2022, available at <http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/10/8737.pdf> (accessed on 31/03/2020)

⁸⁰ Ibid

Utilising Science and Technology for Environmental Management in Kenya

to secure the right to a clean and healthy environment which equates to the right to life.⁸¹

Utilising science and technology in environmental conservation and protection in Kenya is vital. It cannot be ignored.

⁸¹ See the case of *Peter K. Waweru v Republic*, Misc. Civil Application No. 118 of 2004, (2006) eKLR

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