

**UNIVERSITY OF NAIROBI**

**FACULTY OF LAW**

**Assessing the adequacy of the regulatory framework governing the treatment and discharge of industrial effluents: A Case Study of Mavoko, Machakos County**

**MUTTUKU CATHERINE SANITTA**

**G62/87906/2016**

**A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE MASTERS OF LAWS DEGREE IN ENVIRONMENTAL LAW AND NATURAL RESOURCES OF THE UNIVERSITY OF NAIROBI**

**MARCH, 2023**

## **Contents**

|   |      |
|---|------|
| Contents .....  | i    |
| DECLARATION .....   | v    |
| DEDICATION .....  | vi   |
| ACKNOWLEDGEMENT .....   | vii  |
| LIST OF STATUTES AND POLICY DOCUMENTS.....  | viii |
| LIST OF ABBREVIATIONS .....   | ix   |
| LIST OF CASES.....  | xi   |
| 1.0 CHAPTER ONE: INTRODUCTION .....   | 1    |
| 1.1 Background of the Study .....   | 1    |
| 1.1.1 Industrial Water Use Statistics .....   | 1    |
| 1.1.2 Effluent and its adverse effects .....  | 7    |
| 1.1.3 Water Pollution Control: The Necessity of effluent treatment .....  | 8    |
| 1.1.4 Effluents as a Resource.....  | 8    |
| 1.1.5 National Framework for Industrial Effluents Governance.....   | 8    |
| 1.1.6 The Water Resources Authority (WRA).....  | 9    |
| 1.1.7 Ecologically Sustainable Development.....   | 9    |
| 1.1.8 Industrialization and Effluent Discharge in Athi River, Mavoko Sub-County.....                                    | 12   |
| 1.1.9 Water Governance in Mavoko Sub- County .....  | 13   |
| 1.2 Research Problem .....  | 14   |
| 1.3 Research Objectives.....  | 16   |
| 1.4 Research Questions .....  | 16   |
| 1.5 Justification of the Study .....  | 16   |
| 1.6 Research Assumptions .....  | 17   |
| 1.7 Significance of the Study .....   | 18   |
| 1.8 Scope of the Study .....  | 18   |
| 1.9 Literature Review.....  | 19   |
| 1.9.1 Introduction .....  | 19   |
| 1.9.2 Industrial Water Demand .....   | 19   |
| 1.9.3 Effluents Treatment and Discharge.....  | 19   |
| 1.9.4 The current situation in the governance of industrial effluent discharge and treatment in Mavoko sub-county ..... | 20   |

|  |    |
|--|----|
| 1.9.5 To evaluate the adequacy of the regulatory framework governing industrial effluents' treatment and discharge in Mavoko Sub- County .....   | 22 |
| 1.9.6 To assess gaps and opportunities and propose mechanisms for reforming the governance of industrial effluent treatment and discharge in a manner that ensures recycling of effluent to relieve pressure on freshwater sources. .... | 22 |
| 1.10 Trends, approaches, and concepts of industrial effluents management.....  | 23 |
| 1.10.1 The Concept of Industrial Ecology in Industrial Waste Water Management.....   | 23 |
| 1.10.2 Sustainable Development and Industrial Effluents Management .....   | 24 |
| 1.11 Challenges of Industrial Effluents Management.....  | 25 |
| 1.12 The Need for Industrial Effluents Recycling .....   | 25 |
| 1.13 Theoretical approaches to industrial effluents management .....   | 26 |
| 1.13.1 Cooperative Game Theory of Industrial Ecology.....  | 26 |
| 1.13.2 Ecologically Sustainable Development Theory .....   | 27 |
| 1.14 Conclusion .....  | 28 |
| 2.0 CHAPTER TWO: INDUSTRIAL EFFLUENT MANAGEMENT IN MAVOKO .....  | 30 |
| 2.1 Abstract .....   | 30 |
| 2.2 Introduction.....  | 30 |
| 2.2.1 Industrial history of Mavoko .....   | 31 |
| 2.2.2 Enabling factors for rapid industrial growth in Mavoko.....  | 33 |
| 2.3 Industrial Effluent Management in Mavoko .....   | 37 |
| 2.3.1 Waste produced by industries in Mavoko .....   | 37 |
| 2.3.2 Effects of industrial waste on flora and fauna .....   | 40 |
| 2.3.3 Recycling of wastewater by industries in Mavoko .....  | 42 |
| 2.3.4 Discharge of effluent into sewer system and Industrial effluent treatment methods employed by industries in Mavoko .....   | 43 |
| 2.3.5 Poor sanitation and effluent management infrastructure .....   | 47 |
| 2.3.6 Waste & garbage collection mechanisms.....   | 49 |
| 2.3.7 Poor town planning.....  | 50 |
| 2.4 Enforcement measures in place for compliance .....   | 51 |
| 2.4.1 Legislative measures and cases .....   | 51 |
| 2.4.2 Provision of Effluent Discharge License & Permit and Revocation of Licenses & Permit.....  | 54 |
| 2.4.3 Courts of law .....  | 55 |
| 2.4.4 Closing of industries and arresting of project proponents .....  | 56 |
| 2.4.5 Conducting regular Environmental Audits on projects .....  | 57 |

|  |           |
|--|-----------|
| 2.5 Conclusion .....   | 57        |
| <b>3.0 CHAPTER THREE: THE LEGAL AND INSTITUTIONAL FRAMEWORK FOR INDUSTRIAL WASTE WATER GOVERNANCE IN KENYA: REVIEWING THE REGULATORY FRAMEWORK FOR INDUSTRIAL WASTE WATER IN KENYA .....</b> | <b>59</b> |
| 3.1 Introduction.....  | 59        |
| 3.2 The Legal, Policy and Institutional Framework.....   | 60        |
| 3.2.1 Governance of Industrial waste water and its implication on the environment .....  | 60        |
| 3.3 Commentary on the Sustainable Waste Management Act, No. 31 of 2022 .....   | 83        |
| 3.4 Challenges within the regulatory framework.....  | 87        |
| 3.4.1 Complexity of the legal framework for industrial wastewater management.....  | 87        |
| 3.4.2 Institutional failure.....   | 88        |
| 3.4.3 Duplicity of roles .....   | 90        |
| 3.5 Conclusion .....   | 91        |
| <b>4.0 CHAPTER FOUR: INDUSTRIAL EFFLUENT MANAGEMENT: LESSONS FROM THE CASE OF UGANDA AND SOUTH AFRICA .....</b>  | <b>94</b> |
| 4.1 Introduction.....  | 94        |
| 4.2 Industrial effluent management in Uganda .....   | 96        |
| 4.2.1 Policy and regulatory framework.....   | 97        |
| 4.2.2 Effluent produced by industries in Kampala and in KIBP .....   | 99        |
| 4.2.3 Industrial effluent management measures by industries in Kampala and in KIBP .....   | 100       |
| 4.2.4 Effects of the waste produced to flora and fauna .....   | 101       |
| 4.2.5 Effluent treatment methods applied by industries in Kampala and in KIBP.....   | 103       |
| 4.2.6 Reusing of waste produced by other industries in Kampala and in KIBP .....   | 104       |
| 4.2.7 Recycling of wastewater by industries in Kampala and in KIBP .....   | 105       |
| 4.2.8 Challenges in Kampala and in KIBP .....  | 105       |
| 4.2.9 Measures in place to ensure compliance with the regulations by industries in Kampala and in KIBP   | 108       |
| 4.3 Industrial Effluent Management in South Africa .....   | 112       |
| 4.3.1 Policy and regulatory framework.....   | 113       |
| 4.3.2 Industrial effluent Management in Cape Town and in the Industrial Parks in South Africa....  | 115       |
| 4.3.3 Waste produced by industries in Cape Town and in the Industrial Parks in South Africa.....   | 115       |
| 4.3.4 Effects of the waste produced to flora and fauna .....   | 116       |
| 4.3.5 Effluent treatment methods applied by industries in Cape Town and in the Industrial Parks in South Africa .....  | 117       |


|   |     |
|---|-----|
| 4.3.6 Recycling of wastewater by industries in Cape Town and in the Industrial Parks in South Africa                                      | 118 |
| 4.3.7 Reusing of waste products produced by industries in South Africa.....   | 119 |
| 4.3.8 Challenges of industrial effluent management in South Africa .....  | 119 |
| 4.3.9 Remedies for the wrong and how to assure compliance with the regulations by industries in South Africa .....                        | 122 |
| 4.4 Conclusion .....  | 124 |
| 5.0 CHAPTER FIVE: FINDINGS, CONCLUSION AND RECOMMENDATIONS .....  | 127 |
| 5.1 Findings of this Study .....  | 127 |
| 5.2 Does our legislative framework promote or factor in industrial symbiosis and sustainable development concepts? .....                  | 132 |
| 5.3 Conclusion .....  | 135 |
| 5.4 Recommendations.....  | 138 |
| 5.4.1 Sensitization of industries on industrial waste management:.....  | 138 |
| 5.4.2 Sensitization to staff members .....  | 138 |
| 5.4.3 Better coordination between NEMA and WRA: .....   | 139 |
| 5.4.4 Re-using/ Recycling (can the waste produced by one industry be used by another or presence of industrial symbiosis in Mavoko) ..... | 139 |
| 5.4.5 Need to upgrade the exiting industrial business parks and specifically in Mavoko.....   | 141 |
| 5.4.6 Assessment of town planning .....   | 141 |
| 5.4.7 Use of newer and better technologies.....   | 141 |
| 5.4.8 Industrial waste water policy.....  | 142 |
| 5.5 Further research areas recommended .....  | 142 |
| 6.0 BIBLIOGRAPHY.....   | 143 |
| 6.1 Books.....  | 143 |
| 6.2 Online Journals and Journal Articles.....   | 143 |
| 6.3 Thesis .....  | 151 |
| 6.4 Website and News Articles.....  | 151 |
| 6.5 Reports.....  | 153 |
| 6.6 Management Plans .....  | 154 |

**DECLARATION**

I, CATHERINE SANITTA MUTTUKU, hereby certify that this is my original work and hasn't been submitted to another university for the purpose of receiving academic credit or a degree.

**CATHERINE SANITTA MUTTUKU**

**G62/87906/2016 (Candidate)**

Signature:  ..... Date: 1/3/2023 .....

This research project has been submitted for examination with my approval as a university supervisor

Signature:  ..... Date: 9/03/2023 .....

**DR. ROBERT M. KIBUGI (Senior Lecturer, Faculty of Law, University of Nairobi)**

## **DEDICATION**

This paper is devoted to God who has granted me the will and strength, which has allowed me to carry out this study, as well as to my family and friends for their strong support.

I wish to particularly recognize my children Zoly (8.5 years) and Ely (4 years), for being so understanding and supportive –though young- when mommy had to spend nights away from home to work on this study.

I also wish to thank my nanny – Mukami- for being a second parent to my children.

My friends, Sally and Flo for being such pillars of strength when I had ‘those’ moments.

My research assistant Shaibu. Thank you.

## **ACKNOWLEDGEMENT**

I acknowledge and sincerely appreciate the efforts of my supervisor Dr. Robert M. Kibugi in his patience, guidance, reliability as well as dedication throughout this study. His wealth of knowledge and expertise in this area of law was of great value.

I also thank God for empowering me to complete this work.



## **LIST OF STATUTES AND POLICY DOCUMENTS**

1. Constitution of Kenya, 2010.
2. Environment and Land Court Act No.19 of 2011, Laws of Kenya.
3. Environmental Management and Coordination Act No. 8 of 1999, Laws of Kenya.
4. Legal Notice No. 101 of June 2003; (Kenya Gazette Supplement No. 56, Legislative Supplement No. 31) of 13th June, 2003.
5. Minerals Act 50 of 1991, laws of South Africa
6. NEMA (National Environment (Waste Management) Regulations (SI No. 153-2) Regulation) laws of Uganda
7. Physical Planning and Land Use Act
8. Regulation 4(1) of legal Notice No. 101, The Environmental (Impact Assessment and Audit) Regulations 2003
9. Sustainable Waste Management Act No. 31 of 2022
10. The Water Services Act 108 of 1997, laws of South Africa
11. The Atmospheric Pollution Prevention Act 45 of 1965, laws of South Africa
12. The 1982 World Charter for Nature,
13. The Stockholm Declaration of 1972,
14. The Constitution of Uganda 2018.
15. The Constitution of the republic of South Africa, 1996
16. The Environment Conservation Act 73 of 1989, laws of South Africa
17. The United Nations Commission on Environment and Development report (Our common future)
18. Urban Areas and Cities Act
19. United Nations Conference on Environment & Development Rio de Janeiro, Brazil, 3 to 14 June 1992. Agenda 21.
20. Water Act No. 43 of 2016
21. Water (Waste Discharge) Regulations (SI No. 152-4), laws of Uganda
22. Water Act 36 of 1998, Laws of South Africa

## **LIST OF ABBREVIATIONS**

|          |  |
|----------|--|
| EA       | Environmental Assessment                       |
| EIA      | Environmental Impact Assessment                |
| ELC      | Environment and Land Court                     |
| EMCA     | Environmental Management and Co-ordination Act |
| EIPS     | Eco-Industrial Parks                           |
| EISA     | Environmental Impact and Social Assessment     |
| EPZA     | Export Processing Zone Authority               |
| FSM      | Fecal Sludge Management                        |
| KIBP     | Kampala Industrial Business Park               |
| LDK      | London Distillers Kenya                        |
| LEIP     | Lords View Industrial Park                     |
| MAVWASCO | Mavoko Water and Sewage Company                |
| MDEAP    | Mavoko District Environmental Action Plan      |
| NEMA     | National Environment Management Authority      |
| NET      | National Environmental Tribunal                |
| SEA      | Strategic Environmental Assessment             |
| SFD      | Shift Flowing Diagram                          |
| SGR      | Standard Gauge Railway                         |
| SPA      | Service Provision Agreement                    |
| SDGs     | Sustainable Development Goals                  |
| TDS      | Total Dissolved Solid                          |
| TSS      | Total Suspended solids                         |

|        |   |
|--------|---|
| UN     | United Nations  |
| UNDP   | United Nations Development Plan                                 |
| UNEP   | United Nations Environmental Plan                               |
| UNESCO | United Nations Educational Scientific and Cultural Organization |
| UNIDO  | United Nations Industrial Development Organization              |
| WASREB | Water Services Regulatory Board                                 |
| WHO    | World Health Organization                                       |
| WRA    | Water Resources Authority                                       |
| WRMA   | Water Resources Management Authority                            |

## LIST OF CASES

- Adrian Kimotho Njenga vs Council of governance & 3 others (2020)
- British American Tobacco Ltd -vs- Cabinet Secretary for the Ministry of Health & 5 others (2017)
- Brundson -vs- The Council of the City Wagga Wagga (2003) NSWLEC 168
- Friends of Lake Turkana Trust –vs- the Attorney General and 2 others (2014) (Nairobi ELC)
- Godfrey Nyakana -vs.- National Environment Management Authority (NEMA) and Others (Constitutional Appeal No. 5 of 2011)
- Isaac Kipyego Cherop -vs- State Ministry of Water & 142 others (2017)
- Jamal Ahmed Ali & 5 others –vs- NEMA & Another, Tribunal Appeal no.NET 196 of 2016
- Julius Kiriga Mungania & 3 others –vs- District Land Adjudication and Settlement Officer Tharaka District &3 others
- Ken Kasinga -vs- Daniel KiplagatKirui& 5 others (2015)
- KM & 9 others -vs- Attorney General & 7 others [2020]
- Kibos Distillers Limited & 4 others -vs- Benson Ambuti Adeg& 3 others [2020] (CIVIL APPEAL NO. 153 of 2019)
- Kwanza Estates Ltd v Kenya Wildlife Services Environment and Land Civil Case 133 of 2012 [2013]
- Lopez Ostra –vs- Spain (1994)303 Eur
- Mohamed Ali Baadi and others vs Attorney General & 11 others, [2018]
- Mui Coal Basin Local Community & 15 others vs Permanent Secretary Ministry of Energy & 17 others (2015)
- Miscellaneous Judicial Review no.6 of 2019 at fact 8 (Republic v National Environment Management Authority (NEMA) & 2 others; Ex-Parte Misty Mountain Lodge Ltd & another [2020]

Ms. Shehla Zia and Others v. WAPDA [ 15-K of 1992],

Merafong City Local Municipality-vs- AngloGold Ashanti Ltd (2016)

National Land Commission-vs- Attorney General & 86 others (2015)

Peter Mugoya& another vs NEMA & 2 others NET appeal no.99 of 2012

Peter K. Waweru v Republic (2006)

Save Lamu & 5 others v NEMA & another [2019]

South African Human Rights Commission vs Msunduzi Local Municipality and 8 others, 17th  
June 2021

The Social and Economic Rights Action Center and the Center of Economic and Social Rights vs  
Nigeria (2006)

Velasquez Rodriguez vs Hondrus (July 19, 1988, Series C, No.4)

Wangari Maathai (Green Belt Movement) v Kenya Times Media Trust (1989) eKLR



# 1.0 CHAPTER ONE: INTRODUCTION

## 1.1 Background of the Study

### 1.1.1 Industrial Water Use Statistics

The global industrial use of water, governance of the treatment, and discharge of industrial effluent<sup>1</sup> or wastewater vary across countries.<sup>2</sup> Compared to 71% in Europe, just 20% of the industrial and municipal wastewater generated in Latin American countries gets treated.<sup>3</sup> In the Middle East and North Africa (MENA), approximately 51% of urban and industrial wastewater is treated.<sup>4</sup> A significant barrier to managing waste water in African nations is the scarcity of funding for the establishment of waste water facilities, and 32 out of 48 Sub-Saharan African nations lacked records on sewage water and purification.<sup>5</sup>

UNESCO estimates that 500 million people dwell in areas where use of water is two times more than sourced locally renewable water resources.<sup>6</sup> The entire ecosystem relies on clean water.<sup>7</sup> Nevertheless, it is getting tougher to make sure that there is sufficient clean water sources for everybody as populations increase and natural habitats decline.<sup>8</sup> The key to the situation is to cut emissions and enhance wastewater management.<sup>9</sup> Based on a calculation that predicts the cost of treatment and collection as established by UK water corporations, textile wastewater deposited into public sewers in the United Kingdom (UK) are, by consent, liable to a financial discharge fee.<sup>10</sup> Thus the costs of industrial production are not externalized to the environment or the taxpayer.

<sup>1</sup>"Gaseous waste, or other fluid of home, agricultural, or commercial origin that is released into the aqueous environment, whether treated or untreated" is how the phrase is described in Section 2 of the EMCA.

<sup>2</sup>Fact 8: Water for Industry | United Nations Educational, Scientific and Cultural Organization'

<sup>3</sup> 'The United Nations World Water Development Report, 2017: Wastewater: The Untapped Resource - UNESCO Digital Library'. pg 10

<sup>4</sup> Ibid

<sup>5</sup>Wang, H., Wang, T., Zhang, B., Li, F., Toure, B., Omosa, I.B., Chiramba, T., Abdel-Monem, M. and Pradhan, M., 2014. Water and wastewater treatment in Africa—current practices and challenges. *CLEAN—Soil, Air, Water*, 42(8), pp.1029-1035.

<sup>6</sup>The United Nations World Water Development Report, 2017: Wastewater: The Untapped Resource - UNESCO Digital Library'.

<sup>7</sup>Water Quality and Waste Water (2018) page 2.

<sup>8</sup>Ibid.

<sup>9</sup>Ibid.

<sup>10</sup>'Mogden Formula and Trade Effluent Charges' (Water Treatment Services, 16 January 2019).

The USA implements a load-based standard for wastewater management, which integrates the concepts of industrial effluent and atmospheric water quality through the risk modelling of the water body.<sup>11</sup> The Total Maximum Daily Load (TMDL) defines the provided level for a contaminant that complies with a certain water quality standard. In order to lessen impurities in industrial effluents and sewage, such as pathogens, phosphorus, and nitrogen, as well as heavy metals and hazardous compounds, wastewater treatment plants in the USA process roughly 34 billion gallons of effluents daily before releasing the cleaned waters back into rivers.<sup>12</sup>

About 70% of factory emissions in some emerging nations are released contaminated, where they pollute potential freshwater sources.<sup>13</sup> The problem of untreated effluents heavily impacts Africa. Less than 10% of businesses supposedly purify their pollutants in Nigeria before releasing them into waterbodies.<sup>14</sup> South Africa is doing well to recycle her industrial effluent for instance in the thermal power generation, where ESKOM, the biggest energy distributor in Africa and the country's main public utility recycles sewage, thus decreases demand for and strain on freshwater as well as the amount of garbage discharged.<sup>15</sup> Large quantities of water are used purposely for chilling, along with manufacturing of considerable amounts of sewage water that is normally high in salinity, full of pathogens and chemical additives. Reverse osmosis plants with a combined daily throughput of 12 million litres were erected by ESKOM to treat the effluents. The treated water is recycled into the system for industrial processes such as cooling water system and supply water for ion exchange operation. Closer home, Uganda still struggles on this point even as it aims to reclaim her lost economic status glory of the 1970s as a middle income status country.<sup>16</sup> A recent study on the Kampala Industrial and Business Park (KIBP) indicated that industries therein discharge untreated industrial effluent into the environment specifically the Namanve stream, adversely affecting the environment and putting at great risk the health of the populace.<sup>17</sup> With the exception of turbulence, electrical properties, and

<sup>11</sup> Tatjana Schellenberg and others, 'Wastewater Discharge Standards in the Evolving Context of Urban Sustainability–The Case of India' (2020) 8 *Frontiers in Environmental Science* (2020) page4, accessed 29 March 2021.

<sup>12</sup>Melissa Denchak, 'Water Pollution: Everything You Need to Know' (NRDC) (May 14 and 2018) para.5-7

<sup>13</sup>'UNIDO | Department of Economic and Social Affairs'

<sup>14</sup>Supra n.5 pp 85.

<sup>15</sup>Ibid.

<sup>16</sup>Angiro, C., Abila, P.P. & Omara, T. 'Effects of industrial effluents on the quality of water in Namanve stream, Kampala Industrial and Business Park, Uganda.' *BMC Res Notes* 13, 220 (2020) p.1&2.

<sup>17</sup>Ibid.



escherichia coli count, the results revealed that all water performance measures were below the World Health Organization (WHO) criteria.<sup>18</sup> Large concentrations of bacteria, pathogens, or materials that can safeguard dangerous microorganisms from disinfection procedures are shown by turbidity of more than 5 Formazin Turbidity Units (FTU) for domestic uses, caused by the high E. coli levels.<sup>19</sup> High levels of electrical conductivity were as a result of great amounts of mineral ions exposed in the wastewater and this indicate that the specific samples were deliberately ionized and showed the largest absorption of ions because of high amounts of diffused matter.<sup>20</sup>

Kenya has robust laws and regulations dealing with the larger issue of pollution and also the treatment and release of industrial wastewater into the surroundings. First off, the Constitution itself ensures environmental protection from the preface onward, recognizing that the ecosystem is a part of our legacy and needs to be conserved for the good of coming generations. The regulations go further to provide for state benefits and principles of administration joining all persons in the exposition, application and execution of public policy decisions. Sustainable development is among the national values and administration principles mentioned.<sup>21</sup> It is defined as development that satisfies present demands without endangering the incoming generation's needs.<sup>22</sup> The entitlement to healthy and clean environment is likewise guaranteed by the Constitution, which includes the said principle.<sup>23</sup> Thus, the State is expected to ensure the sustainable use and protection of raw materials, put in place systems for ecological impact assessment, environmental assessment, and environmental control, and do away with practices posing a danger to the surrounding for the good of Kenyans.<sup>24</sup> Additionally, it is everyone's duty to obey the law, for the preservation, and ensure the sensible utilization of natural resources.<sup>25</sup> The Bill of Rights includes Article 42, on a clean environment. The Constitution underlines that upholding the freedoms and privileges protected by the Bill of Rights is the State's primary

<sup>18</sup>Ibid.

<sup>19</sup>Ibid.

<sup>20</sup>Ibid.

<sup>21</sup>Ibid, Article 10(2).

<sup>22</sup> See

<[https://sustainabledevelopment.un.org/content/documents/5839GSDR%202015\\_SD\\_concept\\_definiton\\_rev.pdf](https://sustainabledevelopment.un.org/content/documents/5839GSDR%202015_SD_concept_definiton_rev.pdf)> Accessed 10 April 2021. This concept is dealt with in depth later on in this study.

<sup>23</sup>Supra n. 21, Article 42(1).

<sup>24</sup>Supra n. 21 Article 69(1).

<sup>25</sup>Supra n. 21`, Article 69(2).

duty.<sup>26</sup> Thus, the environmental rights now appreciate their recognition in the Constitution of Kenya. As espoused in Article 69(1) (g), the State is obligated to get rid of any procedures and practices that could harm the environment.

The Constitution, which upholds the governance principles that regulate the consumption of clean water, also guarantees the availability of clean water in sufficient quantities.<sup>27</sup> Sustainability, is among the essential principles of water resource management, emission reduction, and control. The foregoing is testament of the significance the Constitution of Kenya has given to environmental rights such as to accord them formal recognition in the Bill of Rights.

The legislation primarily dealing with the issue of pollution and preservation of the surroundings is the Environmental Management and Coordination Act, 1999 (EMCA). This legislation succinctly employs the sustainable development, pollution prevention and polluter pay principles or concepts in its text towards environmental management and conservation. Further, it provides for the issuance of environmental restoration and conservation orders where an entity discharges effluent to the environment causing pollution or harm.<sup>28</sup> The EMCA also provides for elaborate provisions dealing with integrated ecological impact evaluation, ecological quality standards, and ecological assessment and tracking in Parts VI, VII and VIII respectively. The EMCA creates the National Environmental Management Authority (NEMA) for actualization of its purpose.<sup>29</sup> The other important law is the Water Act of 2016 specifically dealing with aquatic schemes. The main purpose of the Water Act is stated as adjustment, supervision and growth of aquatic resources and effluent services.<sup>30</sup> The Water Act establishes the Water Resources Authority and the Water Services Regulatory Board and clothes them with the necessary mandate to carry out the purpose under the Water Act.<sup>31</sup> Section 63 of the Water Act recognizes the provision under Article 42 in line with Article 43 of the Constitution. Section 108 deals with control of trade effluent and requires the handling of the same not to cause pollution or harm to human health among other legal considerations. Under these laws are various regulations, for example, the Water Quality Regulations (2006), and the Waste Management Regulations (2006) which seek to

<sup>26</sup> Supra n. 21 Article 21(1).

<sup>27</sup> Supra n. 21 Article 43(1)(d) and 10 respectively.

<sup>28</sup> Environment Management and Coordination Act, Sections 108 and 112, respectively.

<sup>29</sup> EMCA Section 7.

<sup>30</sup> Water Act, Section 3.

<sup>31</sup> Water Act Sections 11 and 70 respectively.

deal with the issue of industrial effluent and other wastes under the EMCA. These focus on reducing waste output, converting to cleaner methods of production, and separate effluvia at the source. For a long time, various kinds of garbage have been and are still being discarded improperly, which poses major environmental and health risks.<sup>32</sup> The laws have categorized waste and suggested proper disposal techniques for each type of garbage. In accordance with these rules, NEMA issues licenses to landfills, transporters, composers, waste managers, and collection points.<sup>33</sup> By targeting facilities deemed to endanger the surroundings, the licensing uses a risk-based strategy.<sup>34</sup> This initiates a method by targeting on firms that are thought to present a serious environmental concern. The laws set strict and meticulous criteria. Entities which release wastewater into the ecosystem must, among other things, specify the types of waste that must be disposed of at a treatment facility. Along with the type of treatment to be used at the plant, they must also describe how much waste will be disposed of annually. Also, another important regulation under the EMCA is the Environmental Impact Assessment and Audit Regulations 2003 which primarily seek to check on proposed projects so as to ensure that any adverse environmental effects will be arrested and also to keep checking the ongoing projects to see if they do conform to the agreed-upon environmental sustainability approach and sound environmental management practices.

Therefore, these legislations and the regulations thereunder are in tandem with the Constitution. They elaborate provisions on environmental management and conservation, natural resource management, pollution control and prevention and establishing various bodies tasked with the implementation of the mandates. These legislations and their respective subsidiary legislations thereunder will be considered in depth in chapter 3.

The United Nations deems Kenya as a country with water shortage.<sup>35</sup> Compared to the suggested minimum of 1000m<sup>3</sup>, it has fresh water use per inhabitant of 647m<sup>3</sup>. If a nation's annual sustainable freshwater capability is far less than 1,000 m<sup>3</sup>, it is classified as "water-scarce."<sup>36</sup> Approximately 490 000 km<sup>2</sup> of the country's landmass is classified as arid and semi-arid land

<sup>32</sup>Mathews, 'Industrial Discharge in Nairobi, an analysis of regulatory environment,' (2019) p.42. 0

<sup>33</sup>Ibid, pg. 42.

<sup>34</sup>Ibid, pg. 42.

<sup>35</sup>United Nations Environment Programme, Freshwater.

<sup>36</sup> Water Resources Management Strategy 2006-2007.

(ASAL), yet now, it is the region which supports close to 30% of the nation's population and 70% of its cattle production.<sup>37</sup>

Kenya largely depends on its five water towers for its freshwater needs: Mount Kenya, Cherangani Hills, Aberdare Ranges, the Mau Forest Complex, and Mount Elgon for its domestic, agricultural, and industrial usage.<sup>38</sup> The total renewable water resources in Kenya stand at 21-100(109m<sup>3</sup>yr) whereas the unlimited water withdrawals by percentage were: 3.7% for Commercial, 79.2% for Agricultural, and 17.1% for District use.<sup>39</sup> The industrial water withdrawal from renewable water resources in 2016 stood at 0.3 billion m<sup>3</sup>.<sup>40</sup> Kenya is an arid nation whose per capita water supply p.a. is at 647m<sup>3</sup>, below the 1,000 m<sup>3</sup> recommended by the United Nations.<sup>41</sup>

Water use may be classified as domestic, agricultural, and industrial usage, wherein agricultural use includes irrigation, livestock, and fisheries.<sup>42</sup> As most parts of Kenya suffer from acute water shortages, which translates to communities, especially women and children, having difficulties accessing water for basic needs, this situation may lead to conflicts between these three competing needs.<sup>43</sup>

Water as a resource is the lifeblood of the economy; a vital resource in industrial activity/production and thus its quality and supply affect much of industrial activity and progress.<sup>44</sup> Economies depend largely on industries whose main input is water based.<sup>45</sup> Kenya has an ambitious blueprint for development called Kenya Vision 2030.<sup>46</sup> The goal of Vision 2030's Economic pillar is maintaining an average growth rate at 10% per year through 2030. Thus, industrialization will drive the realization of Vision 2030. For the country to effectively achieve this dream, then water as a significant resource needs sound management policies in

<sup>37</sup> National Water Master Plan 2030 – Welcome to Wasreb', pg MA 4.

<sup>38</sup> UNEP, 2010.

<sup>39</sup> FAO, 2009.

<sup>40</sup> See <<https://www.worldometers.info/water/kenya-water/#water-use>> accessed 30 March 2021.

<sup>41</sup> Hezron Mogaka *et al*, Climate Variability and Water Resources Degradation in Kenya: Improving Water Resources Development and Management (The World Bank 2005)

<sup>42</sup> 'National Water Master Plan 2030 – Welcome to Wasreb'

<sup>43</sup> Water Act section 23(1)(a) provides the categorization of water usage.

<sup>44</sup> Wakiaga Phyllis, 'Why Kenya needs an Industrial Water Policy' para.1-5<<https://kam.co.ke/kenya-needs-industrial-water-policy/>> Accessed 11 July 2020

<sup>45</sup> Ibid.

<sup>46</sup> Vision 2030

place to ensure efficient supply, utilization, treatment, discharge and reuse of water without unnecessarily causing depletion of the water sources as well as degrading the environment.<sup>47</sup>

Therefore, this study proposes the actualization of the industrial ecology concept where industries recycle waste as raw materials within the industrial system to minimize waste and environmental degradation.<sup>48</sup> The actualization of the concept would be in tandem with Sustainable Development Goal (SDG) Number 12 on maintaining healthy production and consumption patterns.<sup>49</sup> Targets 12.4, 12.5 and 12.6, which ensure sustainable management of chemicals and their waste throughout their lifespans and lower their transfer to the environment so as to reduce their detrimental effects on the environment and human health are particularly significant in relation to SDG 12. Furthermore, they urge businesses to adopt sustainable methods in an effort to significantly minimize waste output.<sup>50</sup> Under each target is indicators for assessment of the targets. For example, the nationwide recovery rate and tons of recycled content serve as a measure under target 12.5. This study looks at these issues in the later chapters to assess how far our country is and whether our industries are compliant. Besides, the study proposes the re-assessment of available legal and policy frameworks governing the treatment and discharge of industrial effluents, focusing on industries in the Mavoko area to ensure that waste from industries can be reused as raw materials for another and water from effluent recycled.

### **1.1.2 Effluent and its adverse effects**

Effluents are any gaseous or liquid that are emitted either directly or indirectly into the water habitats.<sup>51</sup> Water quality and resource availability are inextricably connected because contaminated water sources may make some uses impossible.<sup>52</sup> Inadequately treated industrial effluents and increased agricultural runoff, along with increased sewage discharges that have not been properly treated, have all contributed to the global decline in water quality.<sup>53</sup> The

<sup>47</sup>Supra, n.34

<sup>48</sup>Dr. Mahindra Pratap Choudhary et al, 'Environmental Degradation: Causes, Impacts and Mitigation,' (February 2015) p.4

<sup>49</sup> SDG Goal 12: Ensure sustainable consumption and production patterns, n.d.

<sup>50</sup>Ibid.

<sup>51</sup> EMCA 1999, Sec 2.

<sup>52</sup>Supra, n.3

<sup>53</sup>'The United Nations World Water Development Report, 2017: Wastewater: The Untapped Resource - UNESCO Digital Library' (n 2).

consequences of releasing untreated or poorly treated industrial effluents vary from causing deleterious consequences on economic activity, to detrimental environmental and human health impacts. Among other consequences, these include the destruction of aquatic ecosystems, the spread of waterborne diseases through tainted freshwater sources, and the ruin of the environment's aesthetic features.<sup>54</sup>

### **1.1.3 Water Pollution Control: The Necessity of effluent treatment**

Effluent discharge regulation, pollution prevention, and control can take two approaches. First is by minimizing and preventing pollution at sources and secondly through end-pipe management techniques, which involves collecting and treating effluents. The third and more sustainable approach to effluents management includes effluents as a resource and the recovery of products during effluents recycling. Around 70% of the effluents that are created in high-income nations are usually treated, compared to 38% in topmost nations and 28% in relatively low-income countries. Only 8% of urban and industrial pollutants are handled in low-income nations.<sup>55</sup>

### **1.1.4 Effluents as a Resource**

Water is renewable. *“Natural processes recycle water to provide a clean and safe resource that, depending on how and how much it is used, is then degraded by various levels of pollution. Water, however, can be recycled after usage and put to a variety of advantageous applications. The quality of the already used water and the particular form of reuse define the level of additional treatment necessary and the associated treatment costs (or reuse objective)”*<sup>56</sup> Effluents can be recycled to create energy sources, drought-resistant water sources (particularly for commerce or agriculture), a supply of minerals for agriculture, and soil conditioning.<sup>57</sup>

### **1.1.5 National Framework for Industrial Effluents Governance**

The Kenyan Constitution guarantees the justice to adequately purify clean drinking water and respect to the governance norms that govern management of water resources.<sup>58</sup> The idea of sustainable development, which is crucial in the sustainable use of freshwater resources, is one of the principles that are highly basic to water resource management, prevention of pollution, and

<sup>54</sup>Ibid.pp 1

<sup>55</sup>Ibid.

<sup>56</sup>Richard Helmer and others (eds), 'Water Pollution Control: A Guide to the Use of Water Quality Management Principles,' (1st. ed) 1997.Ch4 P.92

<sup>57</sup>'Wastewater Management - A UN-Water Analytical Brief' (UN-Water) (2017) p.19&21.

<sup>58</sup> Constitution of Kenya 2010, Article 43(1)(d) and 10 respectively.

environmental control. Article 69 (2) obligates cooperation between the Republic and the people in protecting and conserving the surroundings. Although the environment is governed by the Environmental Management and Coordination Act No. 8 of 1999, there are water sector-specific laws, regulations, policy, and institutional framework. The fundamental law overseeing water governance, particularly pollution prevention and management, is the Water Act, 2016, as read with the Water Quality Regulations 2006 and the Water Resource Management Regulations 2021. Accordingly, no person has a right to dispose of waste of any nature anywhere within Kenya's territory in a way that creates contamination to the surroundings, and individuals seeking to generate harmful waste should seek a license in writing to NEMA.<sup>59</sup> The Water Quality Regulations 2006 obligates industries to put in place the latest anti-pollution technology to treat all wastes they generate and prohibits enterprises from disposing or discharging any form of industrial waste into the environment untreated following the set guidelines by relevant authorities.<sup>60</sup>

The County Governments' role in the disposal of all waste products is to develop systems to help manage effluents treatment, reuse, and disposal.<sup>61</sup> Other institutions established under the various laws, like the Water Services Regulatory Board and the Water Resources Authority, play a crucial part in regulating Water Resources Management laws.

#### **1.1.6 The Water Resources Authority (WRA)**

The WRA is a body created under Section 16 of the Water Act, 2016. The Authority's mandate is to protect the right to safe water by making sure that water resources are managed properly to ensure that there is enough water for everyone, both today and in the future.<sup>62</sup> In discharging its mandate, WRA entrenches the nation's big four progression schedule, Vision 2030 tactical goal on hygiene, and the SDG 6 to make water resources more easily accessible for multiple uses and to enhance their quality and sustainability.

#### **1.1.7 Ecologically Sustainable Development**

Water is an essential feature for industrial processes where it is used as a coolant, a solvent, or raw material. Kenya has an ambitious blueprint for development called Kenya Vision 2030, with

<sup>59</sup> Act No.8 of 1999, section 87 and 88.

<sup>60</sup>Environmental Management and Co-Ordination (Water Quality Regulations, 2006) (Legal Notice No. 121) Rule 17 and 18.

<sup>61</sup>Kenya National Sanitation and hygiene policy 2016 - 2030

<sup>62</sup>'About WRA – Water Resources Authority (WRA)'

one of the pillars being economic abundance and maintaining a 10% annual average economic growth rate through the year 2030.<sup>63</sup> It is thus the case that industrialization will drive Kenya towards the realization of Vision 2030. This tendency in development is anticipated to lead to the formation of industrial companies, which would result in a rise in the complexity and quantity of contaminants.<sup>64</sup> For the country to effectively achieve this dream, water must be valued as a significant resource; sound management policy must be put in place to ensure efficient supply, utilization, treatment, discharge, and reuse of water without unnecessarily causing depletion of the water sources as well as degrading the environment. Therefore, policy, legislative, and other industrial effluents management responses alike should advance the principle of sustainability in enhancing water security for future generations.

This sustainable development concept is well captured in the preamble to the Constitution as well as being noted as one of the domestic principles of governance.<sup>65</sup> This statement is used to describe “development that satisfies present demands without endangering the future society’s capacity to meet its needs.”<sup>66</sup> This concept is in the spirit of Articles 42 and 69 of the Constitution, and includes all aspects of the decision-making process.<sup>67</sup> The ecologically sustainable development (ESD) concept just like the sustainable development concept also seeks the preservation and of natural assets. ESD is termed as "managing, protecting, and enhancing resources so that natural processes, are preserved and the general quality of life, can be improved," according to Australia's National Strategy for Ecologically Sustainable Development (1992). To effectively implement this idea, decision-making procedures must take into account economic, environmental, social, and equity factors.<sup>68</sup> Just like the sustainable development concept, at its core, the ESD concept utilizes the preventive values<sup>69</sup>, cross-generational values<sup>70</sup>, Enhanced assessment, marketing, and incentive systems, as well as ecological sustainability and

<sup>63</sup> Vision 2030

<sup>64</sup> National Environment Action Plan Framework 2009-2013.

<sup>65</sup> Constitution of Kenya, Article 10 (2)(d).

<sup>66</sup> Brief for GSDR 2015, *The Concept of Sustainable Development: Definition and Defining Principles*, Rachel Emas, Florida International University.

<sup>67</sup> Ibid.

<sup>68</sup> Ibid.

<sup>69</sup> This principle states that lack of complete confidence in science should not be used as an excuse for delaying the avoidance of environmental deterioration if there are substantial or irreversible environmental damage threats.

<sup>70</sup> According to this idea, the current generation is responsible for guaranteeing that the environment's productivity and health are preserved] for the benefit of future generations.



biological diversity preservation.<sup>71</sup> As part of the effort of reconciling the incommensurable lines, the ESD concept tries to include the ecosystem into economic thought - how ecology helps growth continue while protecting the natural resources. Beyond the emphasis on intergenerational equity, this is what concept of sustainability actually implies.<sup>72</sup> For sustainable development to work, we must necessarily focus on the natural resources present and conserve and preserve them for their ecological services for our economic progress.<sup>73</sup> For instance, knowing and mastering how to maintain water cycles and supplies, can assist communities and individuals in coping with shocks related to climate change.<sup>74</sup> Similarly in industrial processes, acknowledging that water is a limited natural resource, effluent can be treated and recycled/reused and in the process aid in environmental/natural resource conservation. Therefore, the United Nations Industrial Development Organization (UNIDO) aims to hasten the industrial development of all of its member states in a sustainable and inclusive manner.<sup>75</sup> UNIDO's mandate concurs with SDG 9 on 'Industry, Innovation and Infrastructure'. It aims to equip and empower member states through financial and technical support, policy formulation among other ways in ensuring that industrial development happens while sustainably utilizing resources and managing the environment. This comes against the backdrop of climate change and the attendant effects, reduction and depletion of natural resources as well of pollution of fresh water resources, over exploitation of natural resources among others. Thus, UNIDO seeks for innovation such as green energy, use of environmentally sound technologies, eco-industrial parks and reducing waste, reusing and recycling resources and water in industrial processes etc, among its members to alleviate pressure on natural resources.<sup>76</sup>

Waste water management (in a sustainable manner) is intricately linked to poverty eradication. Being multifaceted, poverty involves hardships including poor diet and health, difficulty obtaining services, inadequate education, and psychological frustration (Narayan et al., 2000).<sup>77</sup> Environment-related health problems disproportionately affect populations in the world's poorest

<sup>71</sup> This necessitates taking environmental considerations into account when valuing goods and services, such as the polluter pays principle.

<sup>72</sup> Bila-Isia Inogwabini, 'Ecology and Sustainable Development,' (February 2019) p.4-5 .

<sup>73</sup> Ibid.

<sup>74</sup> Ibid.

<sup>75</sup> UNIDO in Brief, n. d.

<sup>76</sup> Safeguarding the Environment, UNIDO: Our Focus

<sup>77</sup> Supra, n.3 pp. 27.

countries (WHO, 2016a). In this study lack of quality and sufficient water impacts adversely on the health of the populations as discussed before.

Fresh water and hygiene forms feasible progress objectives (SDG)<sup>78</sup> number 6.<sup>79</sup> SDG 6 puts a focus on the following areas in particular: drinking water and hygiene; quality of water and effluent; water productivity and limited supply; integrated water control; preservation of ecosystems; global collaboration and capacity building; and stakeholder involvement under various objectives to be met.<sup>80</sup> SDG target 6.3 seeks to enhance water quality worldwide by lowering the amount of untreated sewage, preventing dumping, and considerably increasing recycling and safe reuse by 2030.<sup>81</sup> It cannot be emphasized the importance of clean water in sufficient amounts. Water as a necessity for life as well as industrial processes, needs to be dealt with differently, for the resources need a long time to regenerate. This concept thus demands a balance be placed between development and environmental protection.<sup>82</sup>

#### **1.1.8 Industrialization and Effluent Discharge in Athi River, Mavoko Sub-County**

Athi River, also known as Mavoko, is a town within the larger Machakos County. Mavoko is the commercial and industrial hub of Machakos County, covering an estimated area of 852 km<sup>2</sup>. Its population estimate in the 2019 National Census was 322,499 people.<sup>83</sup> The town enjoys proximity to Nairobi capital city. It is strategically positioned in good infrastructure, evidenced by the Nairobi-Mombasa Highway and the Standard Gauge Railway (SGR) cheap and readily available labor, among others which make Mavoko Sub-County flourish as an industrial hub. The river Athi, which flows through the town, inspired the name of the Athi River Town. It starts from the Ngong Hills.<sup>84</sup>

The region is home to businesses in export markets, steelworks, cement plants, and logistics and transportation firms.<sup>85</sup> Examples of manufacturing industries include several cement

<sup>78</sup>UNDP, 2010

<sup>79</sup>*What are the Sustainable Development Goals?* UNDP, 2010.

<sup>80</sup>Ibid.

<sup>81</sup>Ibid.

<sup>82</sup>Kariuki Muigua et al, 'Natural Resources and Environmental Justice in Kenya' (Glennwood Publishers, Nairobi: Kenya 2015) p. 19.

<sup>83</sup> (2019) Volume 1' Kenya Population and Housing Census'

<sup>84</sup> *Exploring the nature of resilience: A trip down Kenya's Athi River*, UN Environment Programme, 2018.

<sup>85</sup> 'Mavoko Municipality – Machakos County' <<https://machakosgovernment.co.ke/mavoko-municipality/>> accessed 29 March 2021.

manufacturing companies such as Athi River Mining Cement Limited, Bamburi Cement, Mombasa Cement, and East Africa Portland Cement Company. Other industries in the locality include Coca Cola Company Limited, Unilever Kenya Limited, BAT Kenya Limited, Allpack Industries Limited, Nestle, Athi River Steel Plant Limited, KAPA oil refineries Limited, Doshi Enterprises, Mabati Rolling Mills, SANPAC Africa Limited, Orbit Chemicals Limited, Decent Developers Limited, Devki Steel to mention a few.

From KAPA oil refineries to Athi River, where the wastewaters are fed into the trunk drain to the water works, the sewer system in Athi River serves a number of commercial customers as well as a few home customers.<sup>86</sup> Connecting the Export Processing Zone Area and the treatment works, is a 19.6 km long concrete trunk sewer with three overhead river crossings and a size range of 525 to 1200 mm. The current plant's design capacity is 6500m<sup>3</sup>/d.<sup>87</sup> Growing population pressures and escalating needs for water, sanitation, and trash collection pose a major threat to Mavoko's ecology. Mavoko town and its surroundings are the main sources of residential and industrial pollution in the River Athi.<sup>88</sup> Huge manufacturing activity, subpar waste disposal, and mushrooming squalor are features of Athi River town, all of which may have adversely affected the quality of River Athi water.<sup>89</sup>

### **1.1.9 Water Governance in Mavoko Sub- County**

In the Mavoko sub-county, water management is under Mavoko Water and Sewerage Company (MAVWASCO), established in the Water Act 2016 that repealed the Water Act 2002.<sup>90</sup> The Mavoko sub-county receives water from the corporation<sup>91</sup> It and the Tanathi Water Works Development Agency are parties to a service provision agreement (SPA).<sup>92</sup> The Water Services Regulatory Board (WASREB), which has specific jurisdiction over the Syokimau, Mlolongo, Athi River, Kinanie, and Kyumbi districts, has granted it a license and subjected it to regulatory oversight.<sup>93</sup> According to the MAVWASCO 2016-2022 strategic plan, it aims to increase water

<sup>86</sup>'Sewer Services - Mavoko Water and Sewerage Company'

<sup>87</sup>Ibid.

<sup>88</sup> See <<https://wra.go.ke/athi-basin-area/>> Accessed 10 April 2021.

<sup>89</sup>Ibid.

<sup>90</sup> MAVWASCO: Vision and Mission, n.d.

<sup>91</sup>Ibid.

<sup>92</sup>Ibid.

<sup>93</sup>Ibid.

production from 140,000m<sup>3</sup>/month in 2015 to 220,000m<sup>3</sup>/month by 2020.<sup>94</sup> Thus, there is a considerable deficit in water supply due to the increasing population and industrial expansion.<sup>95</sup> As the water demand continues to increase, there lacks a proper framework governing the treatment and discharge of industrial waste water to ensure that there is reuse, to deal with the water scarcity problem in that area. Further, with the various industries around, there needs to be a framework to guarantee that any industrial effluents can be reused and recycled amongst industries to reduce waste production and environmental degradation. In this essence, water must be managed sustainably as it is not an infinite resource.<sup>96</sup>

Upon this backdrop, there is a severe need to evaluate the adequacy of institutional and legislative structures controlling industrial water treatment and discharge. The delivery of contaminated or poorly treated wastewaters threatens the fulfillment of article 42 and violates article 10.

## 1.2 Research Problem

Industries are disposing of their effluent without following proper laid down guidelines by the relevant authorities.<sup>97</sup> Even though the constitutional requirement of sustainable utilization of environmental resources is expressly spelled out in the environment and water resources statutes and policies, the Athi River area faces water pollution from industrial effluents discharged into the river environment.<sup>98</sup> The County Government of Machakos conducted deliberate attempts to reign on rogue industries poorly disposing their effluents into the environment.<sup>99</sup> In the recent past, the County Government closed manufacturing companies such as Walker Industries and Edmor Steel Mills in response to the public's outcry in Syokimau over pollution.<sup>100</sup> For instance, in Nairobi County, industries release around 400,000 m<sup>3</sup> of effluents every day, in which two

<sup>94</sup>Mavoko Water and Sewerage Company (MAVWASCO), 'Strategic Plan for 2015-2020' (2016).

<sup>95</sup>Ibid.

<sup>96</sup>Kariuki Muigua *et al*, 'Streamlining Water Governance in Kenya for Sustainable Development,' (2017) p.5&20

<sup>97</sup> Factories closed; owners arrested for polluting the environment, 2019.

<sup>98</sup>Ibid.

<sup>99</sup>Ibid.

<sup>100</sup> Erastus Mulwa, 'Governor Mutua shuts down Walker over Pollution.'(2019).<<https://www.standardmedia.co.ke/eastern/article/2001323399/governor-mutua-shuts-down-walker-industries-over-pollution>> accessed 31 July 2020

effluents treatment plants treat only 192,000 m<sup>3</sup> of it.<sup>101</sup> It substantially compromises the Nairobi River's water quality, where the untreated effluents are often discharged. The situation is not any better in Mavoko Sub- County. The parastatal sewer line at Kinanie was discovered to be broken and lacking. Because of this, the bigger River Athi, which is a vital source of livelihoods downstream, receives the majority of the effluent from companies in EPZA.<sup>102</sup> Lead, arsenic, and chromium, three contaminants contained in industrial wastes, constitute a contamination risk to River Athi, affecting the health of those living downstream.

A 2020 study on the treated waste that the EPZ waste water treatment facility released into the river Athi found that it was inadequate at reducing the levels of environmental contaminants, including heavy metals like mercury, and selenium.<sup>103</sup> Additionally, all of the allowable limits specified by Kenyan and WHO regulations were exceeded for the Total Dissolved Solids (TDS), Total Suspended Solids (TSS), color, and odor.<sup>104</sup> Cadmium and mercury are serious environmental health risks. The impact of cadmium buildup in crops on consumers is substantial.<sup>105</sup> Severe heavy metal intoxication is brought on by the acidity of mercury, a dangerous metal.<sup>106</sup> The sources of lead and chromium in natural streams and lakes are industrial activities, quarrying, welder emissions, and decaying lead pipes, just like mercury and cadmium. Environmental pollutant lead harms human health. Lead concentrations in natural water are around 5 g/L, making it dangerous to people. NEMA itself has acknowledged the non-compliance by industries despite there being laws and regulations for pretreatment and recycling of effluent.<sup>107</sup>

This research paper will discuss the effects of industrial effluents, identify regulatory gaps on industrial effluents management for sustainable development, and propose measures necessary to enhance water resources' sound management in promoting water access, availability, and quality.

<sup>101</sup>'KENYA: 2030 WRG and EPA Support Nairobi in the Management of Industrial Wastewater' (Afrik 21, 9 November 2019).

<sup>102</sup>NEMA, 'Factories Closed, Owners Arrested for Polluting Environment' , 2019.

<sup>103</sup>Godfrey Wafula et al 'Effectiveness of a Wastewater Treatment Plant located at EPZ in reducing Pollutants Discharged into River Athi, Kenya' (November, 2020) p.15<<https://www.researchgate.net/publication/346570501>> accessed 17 May 2021.

<sup>104</sup>Ibid.

<sup>105</sup>Ibid.

<sup>106</sup>Ibid.

<sup>107</sup>Supra, n. 105.

### **1.3 Research Objectives**

- a) To review the current situation in the governance of industrial effluent treatment and discharge in Mavoko Sub- County
- b) To evaluate the adequacy of the regulatory framework governing industrial effluents' treatment and discharge in the Mavoko Sub- County.
- c) To examine the environmental impacts of industrial effluents discharged by industries in Mavoko Sub- County.
- d) To assess gaps and opportunities and propose mechanisms for reforming the governance of industrial effluent treatment and discharge in a manner that ensures recycling of effluent to relieve pressure on freshwater sources.

### **1.4 Research Questions**

- a) What is the current situation in the governance of industrial effluent treatment and discharge in Mavoko Sub- County?
- b) How adequate is the regulatory framework governing the industrial effluents' treatment and discharge in Mavoko sub-county?
- c) What are the environmental impacts caused by the discharge of industrial effluents in Mavoko sub-county?
- d)What are the gaps and opportunities if any in the governance of industrial effluent in Mavoko subcounty?

### **1.5 Justification of the Study**

According to UN-HABITAT, Mavoko is located 25km southeast of Nairobi, and it is the quickest developing town in Kenya due to the expansion of the industrial area towards Athi River along the Nairobi-Mombasa Highway. It is useful for practical development due to its advantageous location and closeness to two major highways that connect Nairobi with Tanzania and the Port of Mombasa.

The water pollution greatly endangers Mavoko's environment from the massively growing industries. Also, the County Government lacks the capacity and a proper legitimacy and strategic support to deal with the treatment of the discharged industrial effluents. Additionally, Mavoko's hot and arid climate and rapid population increase cause a high, water consumption that is not satisfied by the available supply. Due to the poor management of the released industrial effluents, River Athi, the main source for household and commercial use, is severely contaminated.

The United Nations singles out Kenya as one of the states with chronic water scarcity due to its registration of 647 cubic meters' water supply, instead of the global fall standard for water adequacy, 1,000 cubic meters. Industrialization is one of the vehicles that would lead to vision 2030, and Mavoko's industrialization is not an exception. There is a need to strengthen the legitimacy and strategic support governing the treatment and discharge of industrial effluents, to save the environment and ensure sustainable development in Mavoko and Kenya at large.

This study will therefore contribute to legal and strategic policy making, authorities in the national and local governments, NEMA, the Ministry of Trade & Industrialization by informing policy decisions such as prioritizing treatment of industrial effluents for reuse in both industries, domestic use, and agriculture, to lecture about the problem of water unavailability and environmental damage mitigation.

## **1.6 Research Assumptions**

The research project was based on the assumptions that:

1. The policy, legal, and institutional framework governing industrial effluents treatment and discharge in Kenya's Mavoko sub-county are inadequate.
2. Water demand in the Mavoko sub-county is greater than the water supply, especially for industrial and commercial use.

## **1.7 Significance of the Study**

The Vision 2030 is Kenya's aspirational blueprint strategy to develop an industrial nation. Under the economic pillar, the manufacturing sector is one of the priority areas in enabling more than 10% GDP growth in a few years.<sup>108</sup>

Athi River is among the areas forming the larger Nairobi Metropolitan area. It boasts most of the industries found in Nairobi. The most vital input resource required in these industries is water. It is undeniable that adequate and sustainable water provision has been proven to be one of the prerequisites for economic growth and sustainable development of any region. Yet this area suffers from acute water shortages amidst rising industrial and domestic demands.

Given that water is crucial to the production process of most sectors, it is essential to ensure that it is used wisely. Athi river's industries run the risk of not reaching their full capability for social and economic growth if the proper steps are not taken to solve concerns with water supply and demand, treatment, and disposal. The environment will most likely suffer more degradation due to inadequate treatment and discharge of effluents from the various industries. Such occurrences would adversely affect any efforts towards achieving the SDGs, particularly goal number 6 on water and sanitation, and accordingly, increase attention on water resources.

The results of this research will be useful to government authorities, especially in the Ministry of Environment & Water and Ministry of Trade & Industrialization. Emphasis should be placed on reuse and recycling and, where applicable, engage the concept of industrial symbiosis or cyclic economy in the Athi river industrial hub to ensure minimal waste and further that non-biodegradable waste is reused and bio-degradable churned out to nature.

The study will also benefit the industrial and commercial water users who stand to gain immensely if water scarcity is effectively addressed. The research data gathered by this study will be of interest to scholars interested in water management. The research will add literature to the current body of knowledge and give insights into areas requiring further investigation.

## **1.8 Scope of the Study**

The focus here is on the available literature with regards to the treatment and discharge of industrial effluents in Mavoko sub-county. However, the research is unable to fully cover all

<sup>108</sup>*About Vision 2030, The Kenya Vision 2030, n.d.*



household, commercial, agricultural, and recreational uses of water in Mavoko. The study pays particular attention to the strategies in place in the industries, the barriers to effective water demand management, and the industrial community's perception of water management.

## **1.9 Literature Review**

### **1.9.1 Introduction**

Research on water supply, demand, purification, and disposal is presented in this section. It examines water management trends, ideas, and strategies. It also looks at the movements of industrial and commercial enterprise development as regards efficient industrial effluents management. The section also delves into the industrial symbiosis and the cyclic ecology as the theoretical framework on which the study is pinned, where industries can use the waste of another as a resource and further where the non-biodegradable waste is reused. The section ends with a theoretical and conceptual framework for the study.

### **1.9.2 Industrial Water Demand**

Kenya is a water-scarce nation where the majority of administration officials are unable to provide their inhabitants with enough water.<sup>109</sup> The primary uses of industrial water are for cooling, processing, manufacturing processes, energy production, sewage, clean-up and sanitary services, and fire prevention.<sup>110</sup> During specific production processes, industrial water demand may be elastic. It suggests that a rise in the cost of water may lead to technological advancements that lessen water use or improve its quality or enable water recycling.<sup>111</sup> Even only by lessening the strain on freshwater supplies and the amount of effluents produced by human activity, water conservation efforts are always beneficial to the environment and water quality.<sup>112</sup>

### **1.9.3 Effluents Treatment and Discharge**

As earlier noted, Mavoko sub county hosts a number of industries dealing with various products from steel production, cement manufacturing, chemical production, textile production to mention a few. These industries churn out different waste products (organic and inorganic) at the end of the process. Treatment of industrial effluents before discharge into the environment vary

<sup>109</sup>JW Kaluli and Others, 'Towards A National Policy on Wastewater Reuse in Kenya' (2011) 13 10.

<sup>110</sup>Andrew C Worthington, 'Commercial and Industrial Water Demand Estimation: Theoretical and Methodological Guidelines for Applied Economics Research' (2010) 28.

<sup>111</sup>ibid.

<sup>112</sup>Read 'Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan' (1999)

depending on the constituent of the waste. Organic wastes that are easily biodegradable, may just require a simple biological treatment. Organic wastes not easily biodegradable may require a biological adapted treatment method whereas for inorganic wastes mostly minerals may require a physicochemical treatment.<sup>113</sup> Untreated or improperly treated effluent may have adverse effects on both human and plant life. Metals from the industrial, mining, and textile industries, such as iron, lead, chromium, and arsenic, for example, alter plant growth and cause waste buildup and sedimentation. For humans, adverse health effects could include cancer, long-term asthma, skin conditions, depression, harm to internal organs, and disorders of the brain system, among others.<sup>114</sup>

The discharge of untreated or inadequately treated industrial effluents deteriorates the natural water quality. Before discharging effluents to water bodies, an industry should obtain an Environmental Impact Assessment License and an Effluent Discharge License under the Water Regulations.<sup>115</sup> In Nairobi County, for instance, industries release around 400,000 m<sup>3</sup> of effluents per day. Two effluents treatment plants treat only 192,000 m<sup>3</sup> of it. The rest flows into the rivulets that come into contact with the Nairobi River.<sup>116</sup> One of the working effluents treatment mechanisms uses a compact effluents treatment system where a bio-erector is installed under the surface.<sup>117</sup> The system's efficiency is that it does not require skilled personnel to operate, and other facilities can be constructed on top of it and the surface afforested, making the environment beautiful.

#### **1.9.4 The current situation in the governance of industrial effluent discharge and treatment in Mavoko sub-county**

As already noted above, industries in Mavoko area still continue to discharge effluents into the environment, despite the regulatory framework in place. NEMA has on a number of occasions closed down factories discharging untreated effluent or discharging without an Effluent Discharge Licence.<sup>118</sup> With respect to Mavoko, NEMA in its periodical visits or inspection at some point noted that the EPZA sewer line was dysfunctional at Kinanie and thus consequently

<sup>113</sup> Olivier Thomas, Marie-Florence Thomas, Ch.10 - Industrial Wastewater, UV-Visible Spectrophotometry of Water and Wastewater (2<sup>nd</sup> Ed), Elsevier, 2017, Pages 317-348, ISBN 9780444638977.

<sup>114</sup> Ibid.

<sup>115</sup> NEMA - Water Quality Regulations'

<sup>116</sup> 'KENYA: 2030 WRG and EPA Support Nairobi in the Management of Industrial Wastewater' (n 31).

<sup>117</sup> Benenv, 'Compact Wastewater Treatment System'

<sup>118</sup> NEMA, Factories closed, owners arrested for polluting environment.

the industries were discharging effluent directly to the river Athi. Further that EPZA had also failed to abide by the recommendations given to it on effluent management.<sup>119</sup> Also, the Standard newspaper reported on 25<sup>th</sup> October, 2021 that NEMA had issued stern warning to industries discharging effluent into River Athi, following public outcry.<sup>120</sup> NEMA directed the Mavoko Treatments Work not to release further effluent until analysis was done to the samples collected.<sup>121</sup>

Industries in Athi River have adopted efficient regulation of waste water by introducing a recycling mechanism, thus turning waste water into a resource instead.<sup>122</sup> There are still cases of most factories still releasing wastewaters into sewage without purification systems and Effluent Discharge License.<sup>123</sup> Contamination of underground water sources, discharge of raw industrial waste into rivers, and insufficient sewerage networks, remains a threat to Machakos county.<sup>124</sup>

According to a recent survey on the EPZ waste treatment facility, the facility for treating waste water did not successfully reduce impurities.<sup>125</sup> For an effective and proper treatment procedure, it advised greater monitoring of the sources of wastewater received and the extension or redesign of the treatment facility.<sup>126</sup> The study however did not consider recycling of waste as raw materials by the industries in Mavoko, an aspect this present study will seek to consider.

This is enough to conclusively tell that, though EMCA has established appropriate legal and institutional framework for protection against effluent discharge to the environment, the Act still has not achieved maximum effectiveness in preventing environmental degradation through discharge of effluents.

This being an objective of this study, it will be extensively dealt with in the next chapter.

<sup>119</sup> Ibid.

<sup>120</sup> *NEMA issues stern warning to factories discharging waste into Athi River*, Standard Media, 2021.

<sup>121</sup> Ibid.

<sup>122</sup> Brian Jaoko Odongo, 'Assessing water supply and demand management in industries and commercial enterprises in Athi River town, Machakos' (2012). Pp 48,49 & 50

<sup>123</sup> NEMA, *Factories closed, owners arrested for polluting environment*.

<sup>124</sup> Machakos county approved-final County Integrated Development Plan (2018-2022) p.32-34

<sup>125</sup> Wafula, Godfrey & Tole, Mwakio & Dharani, N. & Nadir, Stanley, *Effectiveness of a Wastewater Treatment Plant located at EPZ in reducing Pollutants Discharged into River Athi, Kenya*. 9.(2020) p. 261-276.

<sup>126</sup> Ibid, pg. 275.

**1.9.5 To evaluate the adequacy of the regulatory framework governing industrial effluents' treatment and discharge in Mavoko Sub- County.**

Cary Coglianese in her work, notes that in evaluating regulatory performance there is need for indicators for the problem/behavior sought to be tackled by the regulation, the intended outcome and need for progress checks.<sup>127</sup> This study seeks to find out if the regulatory framework for industrial effluent management in Mavoko is adequate or enough or sufficient by considering the indicators mentioned, seek out the deficiencies if any and also consider what more can be done.

**1.9.6 To assess gaps and opportunities and propose mechanisms for reforming the governance of industrial effluent treatment and discharge in a manner that ensures recycling of effluent to relieve pressure on freshwater sources.**

Lastly, this study will consider current gaps in the regulatory framework for industrial effluent management in Mavoko and give recommendations on the way forward particularly in light of the cyclic economy or the industrial symbiosis theory in enabling sustainable development. Kelvin Khisa *et al* in their study, state that, “Efficient and competitive Special Economic Zones (SEZs) industrial Parks (IPs) will include those that adopt an economy that contains a circular flow of materials and energy, rather than a linear development model.”<sup>128</sup> Although still in its early stages, the study found that waste and by-product exchange occurred at the Athi River SEZ's textile and agricultural processing clusters. It underlines that the lack of a working waste recovery, reuse, and recycling infrastructure has significantly hindered the Athi river SEZ's adoption of the cyclic economic system.<sup>129</sup> The study also noted that most manufacturing industries at the Athi river SEZ were largely linear in that they did not embrace the cyclic economy of reduce, re-use and recycle waste.<sup>130</sup> The research acknowledges that for industrial symbiosis to work, there is need for industrial clusters or industries with need for exchange of resource in close proximity, however, the same needs an enabling policy, institution and regulatory framework.<sup>131</sup> Despite its recommendations, the study does not look into the

<sup>127</sup> Cary Coglianese, *Measuring Regulatory Performance: Evaluating the Impact of Regulation and Regulatory Policy*, OECD (2012) pg. 1-12.

<sup>128</sup> Khisa, K., Oguge, N. & Obiero, S.A, ‘Mainstreaming the Culture of Eco-Industrial Parks (EIPs) in Kenya for the Sustainable Realization of the Country’s Vision 2030’ *Journal of International Business Research and Marketing*, 3(6). (2018) p.7-21.

<sup>129</sup> *Ibid*, pg 7.

<sup>130</sup> *Ibid*, pg. 9.

<sup>131</sup> *Ibid*.

regulatory framework, a point which forms an objective of this study. The research was also restricted to the apparel and agro processing cluster industries.

## **1.10 Trends, approaches, and concepts of industrial effluents management**

### **1.10.1 The Concept of Industrial Ecology in Industrial Waste Water Management**

Industrial ecology is a sustainability concept that envisages the idea that human-made industrial ecosystems operate in similitude to natural ecosystems. This suggests that a procedure's waste or byproduct is employed as an input in another process.<sup>132</sup> This concept develops a symbiotic industrial environment where another utilizes one industry's waste product in their production cycle. It is critical to take into consideration that future water demands cannot be met unless effluents management is revolutionized.<sup>133</sup>

Accordingly, the concept shuns untreated or partially treated effluents discharge, which has undesirable effects on animals and human beings. Waters that are used for manufacturing are degraded in quality due to the introduction of contaminating constituents.<sup>134</sup> Sustainable effluents management results in socially desirable, economically viable, and ecologically sustainable solutions.<sup>135</sup> This entails providing access to clean water and avoiding the release of uncontrolled wastewater into the environment. The systems and procedures used to treat effluents that are generated as a byproduct of business or manufacturing activity are therefore covered by effluents management.

Through water recycling techniques, the cleaned wastewaters (or effluent) may be repurposed or discharged into a sanitary sewer or surface water in the environment.<sup>136</sup> Effluents management or the lack thereof directly impacts biological diversity, which affects the basic ethics of our sustainment systems, upon which several sectors depend.<sup>137</sup> In the industrial cycle, freshwater withdrawal entails water extraction from water bodies in good quality and quantity for use within

<sup>132</sup>'Sustainability Concepts: Industrial Ecology' <<https://www.gdrc.org/sustdev/concepts/16-l-eco.html>> accessed 1 February 2021.

<sup>133</sup>Emily Corcoran, 'Sick Water? The Central Role of Wastewater Management in Sustainable Development: A Rapid Response Assessment' (UNEP/Earthprint 2010).

<sup>134</sup> 'Waste Water Management – The Role of Industries' (Land Portal, 22 March 2017) <<https://landportal.org/node/43609>> accessed 7 February 2021.

<sup>135</sup>Read 'Water and Sustainable Development: Opportunities for the Chemical Sciences: A Workshop Report to the Chemical Sciences Roundtable' at NAP.Edu

<sup>136</sup>'Waste Water Management – The Role of Industries' (n .43).

<sup>137</sup>Corcoran (n. 137).

the supply chain. Contaminants are introduced into the water during the industrial processes and effluents seldom treated are discharged into the environment.

### **1.10.2 Sustainable Development and Industrial Effluents Management**

According to Robert W. Kates *et al.*, to attain many values simultaneously and even synergistically, sustainable development calls for the involvement of many stakeholders and views with the aim of bringing disparate and perhaps incompatible values and purposes together into a new synthesis.<sup>138</sup> The idea propagated herein is that a multi-stakeholder approach should be adopted to realize a long-term and workable solution in industrial effluents management. Philippa also opines a similar note like Kates *et al.*<sup>139</sup> Consequently, despite the growing need for technological advancements and industrial activities that compromise the standard and amount of water readily for human and environmental use, industries should be induced through a policy or legislative framework to develop sustainable effluents management mechanisms. Such mechanisms include industrial treatment of effluents as well as effluents recycling. Michael Lockwood, in his analysis of the Brundtland Report, 1987 advances the principle of inter-generational equity, which must be in consideration during industrial processes that compromise the standard and amount of water. According to him, sustainable development is one that satisfies the requirements of today without preventing future generations from satisfying their needs.<sup>140</sup> By 2030, Kenya hopes to be completely industrialized, creating jobs and adding value to its agricultural products and natural resource reserves for both export and domestic use. It is anticipated that this development trend would spark the expansion of industrial companies, which will lead to an increase in the quantity and complexity of pollutants.<sup>141</sup> Therefore, policy, legislative, and other industrial effluents management responses alike should advance the principle of sustainability in enhancing water security for future generations. Water use limitations and pricing set by the government, along with standards for the quality of wastewaters and impact fees, should encourage commercial and industrial users to use less water.<sup>142</sup>

<sup>138</sup>Kates *et al.*, 'Editorial- 'What Is Sustainable Development? Goals, Indicators, Values, and Practice' (2005) p.4, Volume 47 issue 3, *Environment: Science and policy for Sustainable development*.

<sup>139</sup> Philippa England, 'Problems and Prospects for the Implementation of Sustainable Development in Developing Countries: A Critique of the Brundtland Report', 2 Griffith L. Rev. 147, 160 (1993).

<sup>140</sup> Michael Lockwood *et al.*, 'Managing Protected Areas: A Global Guide' Earthscan, London Sterling, VA ,2009.

<sup>141</sup> National Environment Action Plan Framework 2009-2013.

<sup>142</sup>Read 'Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan' at NAP.Edu (n .37).

### **1.11 Challenges of Industrial Effluents Management**

Several challenges affect the effective management of industrial effluents. For instance, the existing legal and regulatory framework is mainly outdated and fragmented. Indeed, most of the sectoral legislation and strategies connected to effluents management have not been updated for quite a while and may require an overhaul if efficient effluents management is anything to go by. A good example is the EMCA. The results are low enforcement and conflicting sectoral mandates. The absence of a policy framework that points out the law's objectives equally poses a risk in industrial effluents management.

Due to an excessive reliance on facility-based conventional treatment methods, the institutional framework mandated with effluents management is ineffective and unable to carry out its duty. Additionally, environmental impact assessments are frequently needed during the development and implementation stages of treatment systems because they are capital-intensive and expensive, costing millions of shillings.<sup>143</sup>

There is an exacting need to raise awareness and capacity building towards effluents management for reuse. Through its sectoral agencies, Kenya's government should develop and implement effluents reuse policy with guidelines for the maximum allowable levels of heavy metals and other environmental and health hazards in industrial effluents.

### **1.12 The Need for Industrial Effluents Recycling**

Although the urban poor continue to use effluents for irrigation purposes, effluents reuse in Kenya is illegal.<sup>144</sup> Effluents in Kenya are mainly untreated or inadequately treated, thereby posing health and environmental hazards to the unsuspecting citizenry. National effluents reuse policy encompasses guidelines for treatments, discharge, and utilization of industrial effluents. When effluents flow to the ambient environment is decreased or eliminated by greater recycling, industrial water conservation can have a positive ecological impact.<sup>145</sup> There are two main benefits of water recycling. The first one is pollution control, which gets rid of effluents as a

<sup>143</sup>Birguy Lamizana, 'Wastewater Production, Treatment, and Use in KENYA' 8.

<sup>144</sup>Kaluli and others (n.34).

<sup>145</sup>Read 'Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan' at NAP.Edu (n. 37).

threat. Source substitution, which refers to a rise in the total amount of water available for usage, is the second.<sup>146</sup>

### **1.13 Theoretical approaches to industrial effluents management**

#### **1.13.1 Cooperative Game Theory of Industrial Ecology**

It is without a doubt that Kenya has sufficient laws to counter environmental degradation and pollution. The Constitution as the *grund* norm entrenches the protection of the environment as an inalienable right.<sup>147</sup> However, problems arise with implementation and loose structures. For instance, despite NEMA and other regulations, industries continue to pollute the environment and discharge untreated effluents.<sup>148</sup> It is the proposition of this research for enterprises within Mavoko to deliberately incorporate the industrial ecology concept in their processes. The theory is premised on the understanding that industries operate in a system of interdependency with nature and each other. Such that one industrial waste becomes the raw material of another. Also, under this theory, waste material is recycled and reused. Bio-degradable waste is safely released into the environment, whereas non-biodegradable waste is either recycled or used as raw materials for other industries or processes. Similarly, water, an essential resource in industrial operations, is treated and recycled to help deal with the increasing demand for water amid scarce supplies. This way, there will be the realization of sustainably managing resources and safeguarding the environment against pollution particularly against the background of Kenya being a water scarce country.

Helen H. Lou *et al* state that ‘An enterprise ecological system that is well-designed and run should be able to rapidly employ the wastes produced by one member as the feed for various entities with varying risks and the reusing of energy. An ecosystem that is extremely resilient should have efficient resource use and ecological compatibility.<sup>149</sup> Industrial ecology seeks to relate industrial developments, technology, associated changes on <sup>150</sup>society and economy on

<sup>146</sup>Ibid.

<sup>147</sup> Articles 42, 69 and 70.

<sup>148</sup>Supra, n. 105.

<sup>149</sup> Ibid.

<sup>150</sup> These uncertainties are seen as disturbances in the system and would include endogenous factors such as time, operational, and facility uncertainties as well as exogenous factors such as regulations, market demand, supply and price fluctuations, and weather.



biophysical environment.<sup>151</sup>This concept follows the material and energy flow within a system to ensure that the same is recycled and waste is minimized and, in the process, maximize on the advantages to community, the economy, and the environment. Individual interests and potential conflicts among member entities must be taken into consideration for such a complicated structure to function. In essence, this idea advocates for the best possible use of resources.<sup>152</sup> A good example is the creation of ecological industrial parks.

According to the cooperative game theory, the many entities and players agree to work together for the benefit of all (economic and environmental). Industrial ecology's primary goal is to protect the environment while fostering commercial development.<sup>153</sup>

However, getting to that point may be a complex matter given the interaction of members.<sup>154</sup>

### **1.13.2 Ecologically Sustainable Development Theory**

Sustainable development aims to include ecological, social, and economic considerations into all decision-making processes.<sup>155</sup> The ecologically sustainable development (ESD) concept just like the sustainable development concept also seeks the preservation of natural resources. In Australia's National Strategy for ESD, it is defined as exploiting, and protecting local resources so that natural processes are kept and the general quality of life can be increased (1992).<sup>156</sup> To effectively implement this idea, decision-making procedures must take into account economic, environmental, social, and equity factors.

As part of the effort of reconciling the incommensurable lines, the ESD concept tries to include ecological into economic thought - how ecology helps prosperity continue while protecting the natural resources.<sup>157,158</sup> Beyond the emphasis on intergenerational equity, this is what sustainable development actually implies.<sup>159</sup>

<sup>151</sup>Supra, n.136.

<sup>152</sup> Boix, M., Montastruc, L., Azzaro-Pantel, C., & Domenech, S. (2015). Optimization methods applied to the design of eco-industrial parks: a literature review. *Journal of Cleaner Production*, 87, 303-317.

<sup>153</sup>Ibid.

<sup>154</sup>Helen H. Lou et al, 'A game theory-based approach for energy analysis of industrial ecosystem under uncertainty' (2004) p.4-5.

<sup>155</sup>Ibid.

<sup>156</sup> *What Is Ecologically Sustainable Development?* Environmental Defenders Office, 2022

<sup>157</sup>Ibid.

Kenya's ambitious plan under the Vision 2030 of making herself a regional industrial hub, must necessarily incorporate the sustainability concept to ensure that the environment does not degenerate at the expense of economic progress or expansion. For sustainability to happen, countries must make wise use of their renewable resources.<sup>160</sup> The ecologically sustainable development allows for the human economic progress that takes into account natural ecosystems.<sup>161</sup>

Both of these theories have a common goal of conserving or preserving the natural resources while undertaking economic development. For purposes of this study, the ecologically sustainable development theory is the most preferred between the two theories because it is not reliant on a community set-up of industries as is the case with the cooperative game theory of industrial ecology. So, ultimately, all and indeed any industry must have in place structures to tap resources from the industrial effluent to ensure that water is reused while waste produced is reduced, reused and recycled. This way, natural resources will be saved by managing the demand while ensuring economic development in a sustainable manner.

#### **1.14 Conclusion**

The foundation for this research has been described in this chapter. It has also examined existing scholarly articles on the subject of industrial effluents management and addressed the theoretical underpinnings on the subject and concepts that form critical tenets in water's ecological sensitivity as a scarce resource. It is clear from the foregoing that it is of paramount importance to reuse and recycle effluent discharge for reasons already discussed and further because economic development and, in this case, industrial growth primarily depends on water as a primary resource. Literary works are replete with principles on the management of effluent discharge and thus essentially what awaits is deliberate action on the part of all the actors. The concept of management of effluent discharge can have several aspects. However, ultimately

<sup>158</sup> This calls for factoring in of environmental factors in the valuation of assets and services such as polluter pays principle for instance.

<sup>159</sup> Bila-Isia Inogwabini, 'Ecology and Sustainable Development,' (February 2019) p.3-4.

<sup>160</sup> See <<https://ecampusontario.pressbooks.pub/environmentalscience/chapter/chapter-28-ecologically-sustainable-development/>> Accessed 17 May 2021.

<sup>161</sup> Ibid.

effluent discharge would at best be geared towards making the same raw material in an industrial process and consequently the industrial cycle.

## **2.0 CHAPTER TWO: INDUSTRIAL EFFLUENT MANAGEMENT IN MAVOKO**

### **2.1 Abstract**

Industrial effluent management is a well-known challenge to many countries in Africa, both to the developed and the underdeveloped countries. This chapter delves into the history of industrial revolution in Mavoko with a touch on Kenya's industrial and wastewater management. It aims at looking deeply into the enabling factors that accelerated the rapid growth of Mavoko as an industrial town. The chapter will also put consideration on the initial plans put in place for industrial effluent management including the different measures put in place by the various industries for effluent management in Mavoko. The chapter will also touch briefly on the regulatory framework for waste management in Mavoko as well as analyze several mechanisms employed by industries in Mavoko to manage waste and the challenges thereon, the regulations in place and how compliance with the regulations is ensured.

### **2.2 Introduction**

Africa in general has the potential to experience development greater than the East Asian Countries through industrialization.<sup>162</sup> Kenya as a country has been experiencing rapid industrial investments that have boost manufacturing jobs to almost 50%; Kenya has been recognized worldwide as one of the leading economies in Africa due to high level of foreign and local investors.<sup>163</sup> The Government must ensure to boost the country's industrialization, this is because industrial development remains the transforming factor for the country's industrialization programme.<sup>164</sup> The measures should include wastewater treatment and management mechanisms such as waste collating, sorting, segregating etc. Also, treatment and recycling before discharge, to avoid a situation like that being witnessed in large urban centers like Nairobi, where untreated

<sup>162</sup> Economic Report on Africa. 'Industrializing Through Trade,' United Nations Economic Commission for Africa, (2015) p. 18 <[file:///C:/Users/High%20Court%20civil/Downloads/era2015\\_eng\\_fin%20\(1\).pdf](file:///C:/Users/High%20Court%20civil/Downloads/era2015_eng_fin%20(1).pdf)> accessed 17 June 2022

<sup>163</sup> Ministry of Industrialization and Enterprise Development, 'Kenya's Industrial Transformation Programme' (July 2016) p.5- 6

<sup>164</sup> Hannah Wang'ombe, 'Kenya's future lies in industrialization' (October 12, 2015 — updated on July 04, 2020) Para 10 & 11.

wastewater is discharged into the Nairobi, Mathare and Ngong rivers.<sup>165</sup> It should be noted that industrially discharged effluent -that does not adhere to the legal excellence- is the major cause of environmental degradation and increase in demand for fresh and safe drinking water, in most regions in Kenya where rivers are in serious need of rehabilitation.<sup>166</sup>

### **2.2.1 Industrial history of Mavoko**

Mavoko, often referred to as Athi River, is a settlement found in the sizable Machakos County outside of Nairobi.<sup>167</sup> The town is home to Machakos County's Mavoko Municipal Council and the administrative center for Mavoko Sub County.<sup>168</sup>

Mavoko is located some 25km southeast of Nairobi and is among the fast-growing industrial towns in Kenya.<sup>169</sup> When the Nairobi County Council was abolished in 1963, Mavoko was separated from it.<sup>170</sup> Athi River West, Katani, Kinanie/Mathani, Makadara, Muthwani, and Sophia are the six wards that make up the Mavoko municipality.<sup>171</sup> These wards are all a part of the Mavoko constituency, which includes ten wards overall. Within Masaku County Council are the final four wards.<sup>172</sup> In addition to being a town in its own right, Mavoko is one of Machakos County's eight sub-counties or constituencies. It has a total area of 963 km<sup>2</sup> and consists of the six wards named above (Mutua et.al 2017a).<sup>173</sup>

The town first witnessed a quick industrialization process in the 1950s, and during the following decades, this process has been gradually increasing.<sup>174</sup> Only two enterprises, Kenya Meat Commission (K.M.C.) and East African Portland, had been founded by the 1950s when industrialization was inactive before the year 1970.<sup>175</sup> Due to its dry climate, the region around Mavoko didn't experience much growth until the mid-1990s.<sup>176</sup> The town experienced rapid

<sup>165</sup> Kilingo, F., Bernard, Z., & Hong-bin, C. 2021. The Analysis of Wastewater Treatment System Efficiencies in Kenya: A Review Paper. *International Journal of Scientific and Research Publications*, 11 (5), page 205-206. 2

<sup>166</sup> Ibid

<sup>167</sup> Nyasani Mbaka and Benson Osumba, 'Muunganowa Wanavijiji, (Focus on Athi River),' (24 April 2012)

<sup>168</sup> Ibid

<sup>169</sup> Un-Habitat, 'Mavoko Urban Sector Profile,' (2006) p.4

<sup>170</sup> See < <https://placeandsee.com/wiki/athi-river>> accessed 20 April 2022

<sup>171</sup> Ibid

<sup>172</sup> Ibid

<sup>173</sup> GFA Consulting Group GmbH, 'SFD Report Mavoko Kenya Final Report,' (13/09/2018 Last update: 08/10/2018) p.1

<sup>174</sup> Caleb Mc. Mireri, 'Industrialization of Athi River Town' (21May1992) p.68

<sup>175</sup> Ibid page 80

<sup>176</sup> Un-Habitat, Mavoko Urban Sector Profile (2006) p. 6,

increase in industrialization between 1970s through 1980s and 1990s, with 8 new industries in 1970s, 12 and 7 other new industries in 1980s and 1990s respectively.<sup>177</sup> Thus the transition can be said to be by 60% between 1970s/80s and 32% between 1980s/90s, if we were to express it in percentage increase, with a view that within the 1990s about 30 industries would have been developed and about 50 by the year 2000 with an exclusion of those to come through the E.P.Z.<sup>178</sup> True to the prediction, Mavoko municipality now has more than 50 industries.

For purposes of this chapter, to mention a few; Abyssinia Group of Industries, Home source Industries Ltd, Eurostar Industrial Limited, Vintz Industries Ltd, Athi Industrial Parks Ltd, and Welding Alloys Limited.<sup>179</sup> There are also other six cement factories located within the town, these are Bamburi Cement, Mombasa Cement, East Africa Portland Cement Company, Savannah Cement, National Cement and Athi River Mining.<sup>180</sup> The Wrigley Company's chewing gum plant, as well as other illustrious businesses like Doshi Steel, Mabati Rolling Mills, and Devki Steel, are located in the town.<sup>181</sup> Athi River also has industries like NOVA Chemicals, the Kenya Export Processing Zone, which has attracted both skilled and unskilled workers to the companies, steel mills, logistics companies, the leather industry and many more.<sup>182</sup> These industries are located in different parts of the Mavoko municipality.

From the foregoing, it is clear that Mavoko area is an industrial hub. For reasons discussed below, the area continues to attract more industries in an area that is water scarce and further that heavily relies on waters from the River Athi. These industries put a strain on the river resource as the request for clean water for domestic and commercial processes ever increases yet supply is not matched. These industries further pollute the waters of the River Athi by discharging untreated or poorly treated effluent and thus posing threats to the environment and human life.

<sup>177</sup> *Ibid* page 81

<sup>178</sup> *Ibid*

<sup>179</sup> Industries in Mavoko today, 2022

<sup>180</sup> Industry (Athi River) history. Available at <https://placeandsee.com/wiki/athiriver?spmchkbj=spmprvbj6uoz6fEeoyEWlrfgUTwizTmjAi> accessed 28 April 2022

<sup>181</sup> *Ibid*

<sup>182</sup> Mavoko municipality, <https://machakosgovernment.co.ke/mavoko-municipality/> accessed 23 April 2022

There is thus need to have a sustainable way of dealing with this issue so as to conserve the water resources.

### **2.2.2 Enabling factors for rapid industrial growth in Mavoko**

It is worth noting that for Mavoko to thrive with the various industries, their development must have been triggered by several factors. These factors include those mentioned by Caleb M.C Mireri in his thesis titled, 'Industrialization of Athi River Town.'<sup>183</sup> He lists the enabling factors to include inter alia, the town's strategic location, cheap and good industrial land, availability of raw material, affordable living standards, the fact that Mavoko is traversed by the Mombasa Nairobi highway, the Kenya Uganda Railway and the existence of the Jomo Kenyatta International airport. Other factors include devolution and availability of labour, which were not considered in his work. These factors are well analyzed below.

#### ***Devolution***

Article 174 of the Kenyan Constitution (August 2010), calls for decentralization.<sup>184</sup> Amongst the nine goals of devolution,<sup>185</sup> (the ones that come out in relation to this study) are fostering social and economic progress and offering close-by services across Kenya,<sup>186</sup> and the dissolution of state organs<sup>187</sup>, and their functions from the capital.<sup>188</sup> Therefore, it is a fact that the rapid industrial growth in Mavoko town can be attributed to devolution.<sup>189</sup> In order to effectively perform the county's responsibilities and functions under Schedule 4 of the Constitution, the County Assembly was given the authority to create legislation. This included developing and managing the county's infrastructure.<sup>190</sup> The County Assemblies have been granted the latitude to receiving and approving exploitative programs and strategies of the resources in the county.<sup>191</sup> The provisions under chapter eleven or rather under schedule four and Article 185 of the

<sup>183</sup>Caleb M.C Mireri , ' Industrialization of Athi River Town', (1992)

<sup>184</sup>Constitution of Kenya 2010 Chapter11

<sup>185</sup> PLO Lumumba, MK Mbondenyi and T Kabau (eds), 'Devolution in Kenya a Commentary.' Law Africa (2016);13 In Kenya, devolution is referred to be a type of restructuring in which quasi-autonomous local public bodies are given decision-making ability.

<sup>186</sup> The Constitution of Kenya 2010 Article 174(f)

<sup>187</sup>Journal of Resources Development and Management ISSN 2422-8397 An International Peer-reviewed JournalVol.32, (2017) p.25

<sup>188</sup>Gathu Joseph Ndung'u, 'Analyzing the Impact of Devolution on Economic Development Potentialities in KenyaVol.26,' (2014) pp. 11-.16,

<sup>189</sup>Ibid

<sup>190</sup> The Constitution of Kenya 2010 Article 185(2) and 4(b)

<sup>191</sup> The Constitution of Kenya 2010 Article 185(4)(a)

Constitution have allowed counties, as was stated by Gathu Ndung'u in his work, to make policies that sooth investors as well as to regulate the profile of the municipalities.<sup>192</sup> For example the Mavoko municipal council, is empowered under devolution to make by-laws regarding the municipality of Mavoko.

### ***Cheap and good industrial land***

Caleb Mireri in his work opines that availability of cheap land for industrial investments is among the key factors for industrial development in Mavoko.<sup>193</sup> According to him, the proprietors of the then-existing enterprises claimed in a statement that an industrial land in Nairobi could cost up to 70 times as much as one in Athi River.<sup>194</sup> Also that others like the owners of the recent industries like the Gal Sheet and Pepe stated that apart from the high cost factor of an industrial land in Nairobi, finding a suitable piece of land in the proper area of the needed size was nearly impossible.<sup>195</sup> It was therefore very easy for a developer to find land that could accommodate the industrial investment intended and for expansion of the same in Mavoko. For instance, industries like Bluetan, Galsheet, Autospring and K.M.C, which have 18, 20, 10 and 211 acres respectively.<sup>196</sup> The land in Mavoko town was also plain and suitable for industrial construction. Also in 1991, Chapman presented an argument stating that shortage of space was the obstacle for industrial growth in the inner city of Nairobi making Mavoko region best for industrial investments.

### ***Strategic location***

The town's position gives it strategic value because it appears to present an excellent potential for the Nairobi Metropolitan Region to grow. Due to its advantageous position, Mavoko has quickly changed from a ranching community to one that is primarily industrial and commercial (AWSB 2014; Francis 2010).

Mavoko is traversed by the main Mombasa-Nairobi highway, Kenya-Uganda Railway, and the standard gauge railway. The town is also close to the Jomo Kenyatta International Airport, which makes it more attractive for investment. The town is located not far from Nairobi, just 25 km,

<sup>192</sup>Gathu Joseph Ndung'u, 'Analyzing the Impact of Devolution on Economic Development Potentialities in Kenya Vol.26,' (2014) pp. 11-16,

<sup>193</sup> Supra (n. 192) pg 69-72.

<sup>194</sup>Caleb Mc. Mireri, 'Industrialization of Athi River Town' (21May1992) p.69-72

<sup>195</sup> *Ibid.*

<sup>196</sup> *Ibid* page 70



which makes it favorable for people who work in Nairobi and Machakos to live and commute to work.<sup>197</sup>

### ***Raw material***

Mavoko sub county has various materials for construction like sand and building stones that are found within the sub county; also having high amounts of limestone that supply raw material to the East Africa Portland cement.<sup>198</sup> Additionally, the Saj Ceramics Factory in Athi River processes the granite deposits in Mavoko to create tiles.<sup>199</sup> There are other materials used in industrial construction like the ballast and machine cut stone found in quarries like the Crescent, Quality Quarries, Kay Construction, and the Kenya Builders and Concrete Ltd among others.<sup>200</sup> However, industries in Mavoko still pull raw materials from other counties in Kenya, because the raw materials available in Mavoko amount to an estimate of only 13% due to high industrial development.<sup>201</sup> For example, the East African Portland cement company carries limestone from Brussels in Kajiado and Kunkur, from Sultan Hamud, because the area cannot provide all the industries with organic matter directly.<sup>202</sup>

### ***Good transport and communication mechanisms***

The actual large and smaller market locations in Mavoko Sub County are connected by a road system that spans 1562.9 kilometers and provides access to industrial sectors.<sup>203</sup> Mavoko highly relies on several tarmacked roads for transport to boost transportation of raw material and end products from and to industries in/out of the Mavoko municipality. The road network includes the Nairobi – Mombasa, Nairobi – Garissa, Nairobi – Kitui, Nairobi – Kangundo and Kangonde – Embu and also the major ones radiating from Machakos town.<sup>204</sup> The Kenya-Uganda Railway is also a stable means of transport used to transport cement and maize from Athi River to Konza depot on the Mombasa line. The town's telecommunications infrastructure has grown as a result of the connection of various trading hubs to telephone and energy networks.<sup>205</sup> Another

<sup>197</sup>Un-Habitat, 'Mavoko Urban Sector Profile,' (2006) p.4

<sup>198</sup>Machakos District Environmental Action Plan (Machakos DEAP 2009-2013) p. 55

<sup>199</sup> *Ibid*

<sup>200</sup>*Ibid*

<sup>201</sup>Caleb Mc. Mireri, 'Industrialization of Athi River Town' (21May1992) p.91

<sup>202</sup> *Ibid*

<sup>203</sup>*Ibid* pg 51

<sup>204</sup> *ibid*

<sup>205</sup>Machakos County Integrated Development Plan II (2018-2022) p.55 accessed 9 June 202

important factor in drawing investors to Athi River town and the developed EPZ is the nearby Jomo Kenyatta International Airport, which is only 20 km distant. Mireri adds that businesses who import raw materials or export finished goods can benefit from the Inland Container Depot in Embakasi. Two such businesses are Bluetan and Santowel, which export finished goods and import the majority of their raw materials, respectively.<sup>206</sup> The expansion of Mombasa Road, construction of the Athi River interchange, and the construction of the SGR and Athi River Super Bridge currently underway, has improved infrastructure in Athi River which is said to have boosted industrial growth in the town.<sup>207</sup>

### ***Market and industrial linkages***

Market and the geographic location go hand in hand. One of the key elements that draws businesses to Athi River is the proximity to the market. The town is only 20km away from Nairobi which tends to be the main market center.<sup>208</sup> A close market is important for reducing transport cost; by lowering the cost of transportation to the marketplace and permitting direct interaction with salespeople and customers, the Nairobi-Athi River closeness promotes industrial development and facilitates the flow of information about product quality and demand.<sup>209</sup> It is also important to note that there existed some industrial linkages which saw most of the industries relating with those in Nairobi, by supplying finished products or raw materials to them.<sup>210</sup> For instance, Werrot has a sales office in Nairobi, and NOVA Chemicals provides finished goods to her Nairobi Sales Office. The linkages are very little but since they added up on industrial development then it is good to note them.<sup>211</sup>

### ***Availability of Labor***

Labour is among the most important factors for industrial development. Mavoko is some 25km from Nairobi and among the fast-growing industrial towns in Kenya.<sup>212</sup> This geographical advantage improved industrial development in Athi River due to the availability of both the skilled, semi-skilled and un-skilled labor. The Kenya Export Processing Zone is known to attract

<sup>206</sup> Caleb Mc. Mireri, 'Industrialization of Athi River Town' (21May1992)75-76

<sup>207</sup> Cytonn Real Estate. Athi River investment opportunity, page 1. accessed 7 May 2022

<sup>208</sup> Ibid (n.214)72-74

<sup>209</sup> Ibid page 72

<sup>210</sup> Ibid page 73

<sup>211</sup> Ibid page74

<sup>212</sup> Un-Habitat, 'Mavoko Urban Sector Profile,' (2006) p.4

both skilled and unskilled workers.<sup>213</sup> Mavoko acted as a shield for the people who could not find employment at the City of Nairobi due to overcrowding, and opted to look for jobs at Mavoko town.

In conclusion, the factors discussed above still make Mavoko area attractive for industrial business. As Kenya seeks to industrialize herself in line with Vision 2030 goals, it becomes paramount for her to make sure that the environment (water resources) is not unnecessarily degraded, natural resources are utilized sustainably and that industries employ newer and greener technologies in the industrial processes.

### **2.3 Industrial Effluent Management in Mavoko**

Mavoko municipality is said to be the commercial and industrial hub for Machakos County.<sup>214</sup> The industries located within the Mavoko municipality include firms in export processing zones, steelworks, cement plants, and transportation and logistics firms,<sup>215</sup> as stated at the beginning of this chapter under the industrialization history of Mavoko.

#### **2.3.1 Waste produced by industries in Mavoko**

The importance of effluent management is to solve the problem of ecological degradation such as contamination of clean water,<sup>216</sup> to preserve the environment for now and the future,<sup>217</sup> to protect the right to a clean environment,<sup>218</sup> and to promote harmony between growth and a clean environment.

As was previously noted, the enterprises within Mavoko municipality are recognized as contributing to organic, inorganic, and aesthetic water contamination through their industrial effluent and sewage,<sup>219</sup> which find their way into water sources through untreated sewage, seepage from waste sites and septic tanks run-off.<sup>220</sup>

<sup>213</sup><https://landpages.co.ke/blog/2020/05/04/rapid-urban-sprawl-in-athi-river/>

<sup>214</sup>Mavoko Municipality website < <https://machakosgovernment.co.ke/mavoko-municipality/> >accessed 14 May 2022

<sup>215</sup> Ibid

<sup>216</sup> Juma Lillian Adhiambo, 'WasteWater Management: a case of reducing wastewater release into environment in mathare north', (2014.) pp.9-14

<sup>217</sup> Constitution, the Preamble

<sup>218</sup> Constitution, Article 42

<sup>219</sup> John Omung'ala Aywa, 'Suitability of Athi River water for irrigation within Athi river town and its environs,' (2017) 7 accessed 24 June 2022

<sup>220</sup> Ibid

Industries in Mavoko are also associated with the production of heavy metals like magnesium, sodium, chromium, lead and other metallic ions through industrial effluent.<sup>221</sup> The types of raw materials utilized and the effectiveness of the industrial process always affect the character of any wastewater produced.<sup>222</sup> The cement industries use chemicals such as acid and bases,<sup>223</sup> gypsum, pozzolana<sup>224</sup> and clinker that is made from coral limestone as raw materials.<sup>225</sup> The operation of cement industries result in production of chemical waste, poisonous waste, and other harmful emissions.<sup>226</sup> Cement production is also associated with the production of vaporous toxins.<sup>227</sup> There is also the production of Nitrogen oxide from the cement production process which pollutes the environment with Nitrogen compounds like nitric acid, nitrogen dioxide, nitrous oxide and nitrates.<sup>228</sup> For Sulfur dioxide, the NOx mixes with water and other compounds to form a variety of chemicals responsible for degrading water quality if discharged into water ways or water bodies, and formation of acid rain.<sup>229</sup>

A notable illustration of a steel factory is the Athi River Steel Plant, which produces hot-rolled steel products like construction steel, structural steel, bolts, and nuts using scrap metal as the raw material.<sup>230</sup> Other important raw materials for steel production include coal which is heated to produce coke, processed iron ore and limestone or burnt lime.<sup>231</sup> The steel production process is linked with the production of waste especially in manufacturing of the steel products. There are effluents that emanates from cleaning and chemical waste from the chemicals used

<sup>221</sup> Shadrack Mulei Kithiia , 'Water Quality Degradation Trends in Kenya over the Last Decade' ( 2010) 522, accessed 24 June 2022

<sup>222</sup>Kiongo, P. K., Wahome, C. N., Muthama, P. M., Muhonja, J., Ngumba, L., Hassan, F., & Momanyi, E. (2021). Evaluation of Effluent Discharge from Steel Manufacturing Industries on the Proliferating Environmental Degradation in Nairobi Metropolitan in the Republic of Kenya. *Journal of Geoscience and Environment Protection*, 9(9), 198-226.

<sup>223</sup> This is mostly for the production of expensive cement it requires acid-base reactions which mainly is composed of Calcium and Sulphate ions, or the use of Silicic acid and Calcium hydroxide, page11 2

<sup>224</sup>This includes any volcanic material, such as pumice or volcanic ash, that is primarily made of volcanic glass. Pumice and volcanic ash both contain a highly porous glass as their primary active ingredient. 2

<sup>225</sup> Philip Manyi Omenge, 'Environmental Impact Assessment Study report for the proposed Expansion of Mombasa Cement Athi River Cement Gridding Plant' (2017) 65

<sup>226</sup> Valentined Cheruyot, 'Integration of corporate environmental responsibility in cement production process (a case of Athi River cement mining in Kilifi County)' (University of Nairobi, 2021, Nairobi.) 1

<sup>227</sup> Ibid

<sup>228</sup> Ibid

<sup>229</sup> By contributing to the development of smog and acid rain, NOx serves as a representation of nitrogen oxides' contribution to air pollution. 2

<sup>230</sup>See in Athi River steel Plant ltd, pg 1

<sup>231</sup> Science Encyclopidia, 'Science & Philosophy: Spectroscopy to Stoma (Pl. Stomata). Steel raw materials, Manufacturing processes, Quality control, Byproducts and waste and the future'

during the processing of steel products such as Lead, Chromium, Vanadium, Copper, Manganese and Nickel for alloy steel.<sup>232</sup>

Chemical industries are associated with production of heavy metals in their final waste because they use raw materials which are rich in heavy metals. For example, the raw materials for chemical industries include inter alia, Dichloromethane, Sodium chloride, Sulphuric acid, Sodium chloride, Calcium hydroxide Potassium iodide, Hydrogen sulphate, Ammonia, Methanol, Charcoal and Bromine for production of Fenofibrate, Valsartan, Rabepzole, Sodium, iopedridone, Minodronic acid, Adrenaline, Hydroxyethyl, ethoxyypipera, zinc, Chlorine chloride, and Bromo benzyl cyanide.<sup>233</sup>

The chemical industries just like oil refineries, are generally associated with the production of wastewater emanating from the treatment processes, and wastewater emanating from the cooling of the tower and washing.<sup>234</sup> Other waste linked with chemical processing is sewerage generation, flue gas emission and hazardous waste.<sup>235</sup> Mavoko municipality hosts the NOVA chemicals industry which manufacture chemicals and plastic resins,<sup>236</sup> and is also linked with the production of most of the waste mentioned above. Other chemical industries in Mavoko include inter alia, the Pleam chemical, Petna chemical and Plat co. ltd.<sup>237</sup>

<sup>232</sup>Kiongo, P. K., Wahome, C. N., Muthama, P. M., Muhonja, J., Ngumba, L., Hassan, F., & Momanyi, E. (2021). Evaluation of Effluent Discharge from Steel Manufacturing Industries on the Proliferating Environmental Degradation in Nairobi Metropolitan in the Republic of Kenya. *Journal of Geoscience and Environment Protection*, 9(9), 198-226.

<sup>233</sup> Environmental Impact Assessment report of m/s kalki chemical industries for manufacturing of organic chemicals expansion project (2018) pp.31-61. 2

<sup>234</sup> Hazardous Waste Cleanup: Commonwealth Oil and Refining Company, Incorporated in Peñuellas, Puerto Rico.

<sup>235</sup> *Ibid*

<sup>236</sup> NOVA Chemicals <<https://www.novachem.com>> accessed 5 August 2022

<sup>237</sup> See

<[https://www.google.com/search?q=chemical+industries+in+athi+river&sxsrf=ALiCzsbz6FLvBAYOx1\\_lh6JFakWkfr0Hng%3A1659643733895&ei=VSfsYpaXNs6W9u8P6KaD4As&ved=0ahUKewjWldnZ\\_q35AhVOi\\_OHHWjTALwQ4dUDCA4&uact=5&oq=chemical+industries+in+athi+river&gs\\_lcp=Cgdnd3Mtd2l6EAMyBQghEKABMggIIRAeEBYQHToHCAAQRxCwAzoECCMQJzoGCAAQHhAWOgcIlxDqAhAnOgUIABCABDoFCC4QgAQ6CAgAEIAEELEDOggIABCxAXCDAToGCCMQJxATOGQIABBDOgQILhBDOgoILhDHARDRAXBDogSABCABBCCxAXCDAToFCAAQYwE6CAgAEMkDEMsBOgUIABC SAzoLCC4QxwEQQQMQYwFKBAhBGABKBAhGGABQ2ghY9acBYJqsAWgFcAF4BIABogqlAbfxAZIBDzMtMTAuMTEuMTAuMTAuN5gBAKABAbABCsgBCMABAQ&sclient=gws-wiz](https://www.google.com/search?q=chemical+industries+in+athi+river&sxsrf=ALiCzsbz6FLvBAYOx1_lh6JFakWkfr0Hng%3A1659643733895&ei=VSfsYpaXNs6W9u8P6KaD4As&ved=0ahUKewjWldnZ_q35AhVOi_OHHWjTALwQ4dUDCA4&uact=5&oq=chemical+industries+in+athi+river&gs_lcp=Cgdnd3Mtd2l6EAMyBQghEKABMggIIRAeEBYQHToHCAAQRxCwAzoECCMQJzoGCAAQHhAWOgcIlxDqAhAnOgUIABCABDoFCC4QgAQ6CAgAEIAEELEDOggIABCxAXCDAToGCCMQJxATOGQIABBDOgQILhBDOgoILhDHARDRAXBDogSABCABBCCxAXCDAToFCAAQYwE6CAgAEMkDEMsBOgUIABC SAzoLCC4QxwEQQQMQYwFKBAhBGABKBAhGGABQ2ghY9acBYJqsAWgFcAF4BIABogqlAbfxAZIBDzMtMTAuMTEuMTAuMTAuN5gBAKABAbABCsgBCMABAQ&sclient=gws-wiz)> accessed 5 August 2022

### 2.3.2 Effects of industrial waste on flora and fauna

Industries in Mavoko produce wastewater which is rich in Biochemical Oxygen Demand (BOD),<sup>238</sup> and Chemical Oxygen Demand (COD),<sup>239</sup> and if discharged into the water, it makes it impossible and difficult for aquatic life to exist and their normal functioning by exerting pressure for oxygen available.<sup>240</sup>

COD causes an increase in osmotic potential of water and adjacent soils thus making it difficult for organisms and plant life by interfering with the process of osmosis, which sustains plant life.<sup>241</sup> Effluent discharged by industries and untreated sewage or leakage or over flow of untreated waste into rivers also causes microbial contamination in River Athi.<sup>242</sup> This has exposed farmers, consumers of vegetables and other people who contact water from River Athi to the risk of getting gastrointestinal illness, cancer, skin irritation, ear, eye and nose infections and respiratory illness.<sup>243</sup>

Also, the industries located in Mavoko are connected with the production of heavy metals in their final waste especially those using raw materials rich in heavy metal ions. This can be drawn from Jesang Koech's work stating that industries using raw material rich in heavy metal ions like smelting industries, hides and skin industries which uses chromium for skin turning, are more susceptible for production of final waste rich in heavy metal ions.<sup>244</sup> These metal ions are known for causing cancer, renal dysfunction, paralysis, diarrhea, stomatitis among other harmful diseases to human being.<sup>245</sup> Also due to bio accumulation these metal ions can cause large amounts of heavy metals in animal and plant tissues.<sup>246</sup>

<sup>238</sup> Daoliang Li, Shuangyin Liu, 'Water Quality Monitoring and Management, Elsevier' (2019) Ch12 p. 303-328

<sup>239</sup> The COD is the volume of oxygen required to oxidize organic material in water. COD testing is used to assess the content of organic compounds in a water sample along with the amount of oxidation that will take place. A sample's inorganic elements can be counted via COD testing.

<sup>240</sup> 'Strategic Environmental Assessment Study in the Master Plan for Development of the Kinanie Leather Industrial Park' (November 2015) p.118

<sup>241</sup> Ibid

<sup>242</sup> John Omung'ala Aywa, 'Suitability of Athi River water for irrigation within athi river town and its environs' (2017)7

<sup>243</sup> Ibid

<sup>244</sup> Kosgey, J., Koech, J., Bunyasi, S., Kipkemoi, B., Muthoka, T., & Nyabaro, O. (2015). Determination of Heavy Metals Pollutants in Sediments along the Banks of Athi River Machakos County, Kenya. p. 1

<sup>245</sup> Ibid

<sup>246</sup> Shadrack Mulei Kithiia, 'Water Quality Degradation Trends in Kenya over the Last Decade' (2010)p. 522<[file:///C:/Users/pc/Downloads/Water\\_Quality\\_Degradation\\_Trends\\_in\\_Kenya.pdf](file:///C:/Users/pc/Downloads/Water_Quality_Degradation_Trends_in_Kenya.pdf)>accessed 24 June 2022.

Also, the discharging of untreated wastewater into public sewer systems which then find its way into rivers poses a great health hazard to wellness and to the surroundings; as it increases the chances for the outbreak of water-borne diseases.<sup>247</sup>

Discharge of untreated sanitary wastewater and waste oil by industries like the cement industries can also cause degradation of water quality; <sup>248</sup> WRA in 2015 also expressed the fact that in Mavoko sewage disposals and industrial discharges were the main cause for environmental degradation.<sup>249</sup>

Industry owners must also understand that discharge of industrial effluents into the environment or into water sources has toxicological effects on the well-being of aquatic organisms and on provision of fresh and domestic water. This is because effluents destroy the natural habitat for aquatic organisms.<sup>250</sup> A report by Kenya's 12<sup>th</sup> parliament done during the 2<sup>nd</sup> session of August 2018, that was to come up with an estimate on pollution by the London Distillers Kenya Limited (LDK), showed that LDK directed its liquid waste to River Athi.<sup>251</sup> Consequently, it caused 15,000 people to suffer silently, risks of getting skin cancer and respiratory diseases as well as other negative effects to game animals, fish, water animals and plants which were also noted to have increased.<sup>252</sup>

Other than the LDK, most companies in Mavoko have been discharging raw waste into the public sewer which has also caused the pollution of rivers, such as those in the EPZ which

<sup>247</sup> Stanley Nadir, N.Dharan, Mwakio p. Tole, Godfrey Wafua, 'Effectiveness of a Wastewater Treatment Plant located at EPZ in reducing Pollutants Discharged into River Athi, Kenya' (November 2020)p.1

<sup>248</sup>Environmental Impact Assessment study report for the proposed expansion of Mombasa cement Athi River cement grinding plant (2017) pp. 96-97

<sup>249</sup> National Water Resources Situation report for fy2015/2016 (July 2016) p.6

<sup>250</sup> Kiongo, P. K., Wahome, C. N., Muthama, P. M., Muhonja, J., Ngumba, L., Hassan, F., & Momanyi, E. (2021). Evaluation of Effluent Discharge from Steel Manufacturing Industries on the Proliferating Environmental Degradation in Nairobi Metropolitan in the Republic of Kenya. *Journal of Geoscience and Environment Protection*, 9(9), 198-226. p.4-6 2

<sup>251</sup>See [http://www.parliament.go.ke/sites/default/files/2019-09/LDK%20REPORT\\_compressed.pdf](http://www.parliament.go.ke/sites/default/files/2019-09/LDK%20REPORT_compressed.pdf) accessed 27 February 2022

<sup>252</sup> LDK report-compressed (2019) p. 6-8

had to be closed together with the Apex Coating East Africa, Kamongo waste recycling, Sameer agriculture among others.<sup>253</sup>

It is undeniable that Mavoko municipality has a poor history of waste management.<sup>254</sup> This has seen most of the industries in Mavoko struggling to come up with strategies that will improve their effluent management status. For example, the Grain Bulk Athi River Terminal which intended to rely on recycling of wastewater, discharging of effluents into sewer systems, treatment of wastewater before discharging into public sewer and transportation and storing of wastewater and cleaning of any oil spillage.<sup>255</sup>

### **2.3.3 Recycling of wastewater by industries in Mavoko**

Recycling refers to the act of putting used objects and materials through a process so that they can be used again.<sup>256</sup> Utilizing treated wastewater for advantageous uses including irrigation of gardens and farms, industrial activities, wastewater reuse, and refilling ground water basins is known as wastewater recycling.<sup>257</sup> Recycling of wastewater in Mavoko contributes towards reducing the issue of limited availability of fresh portable water, which is the main goal as per Juliana Mutua *et al* work.<sup>258</sup> The benefits are not only for Mavoko alone but for the world at large. Recycling has enabled mining, power and mineral processing industries to reduce impact of wastewater to the environment, to reduce the high demand for fresh water supply, to improve sustainability and to reduce fees for both wastewater transportation and for non-compliance with the regulations on wastewater management.<sup>259</sup>

In Mavoko municipality recycling of wastewater dates back to the 1990s when some industries adopted the mechanism with a good example being the Gal sheet Ltd, which recycled wastewater

<sup>253</sup> NEMA, Factories closed, owners arrested for polluting environment

<sup>254</sup> John Omung'ala Away, 'Suitability of Athi River water for irrigation within Athi River town and its environs' (2017) p.15

<sup>255</sup> EIA-1635 Grain Bulk Athi River Terminal (SR-1598)-mini pdf (September 2019) p.48<[https://www.nema.go.ke › Docs › EIA\\_1630-1639PDF >](https://www.nema.go.ke › Docs › EIA_1630-1639PDF >)12 May 2022

<sup>256</sup> Oxford Student's Dictionary, 3<sup>rd</sup> edition (2012 UK) p.593.

<sup>257</sup> Environmental Engineering, < <https://theconstructor.org/environmental-engg/recycling-of-wastewater/7001/>>accessed 14 May 2022

<sup>258</sup> Juliana Mutua & Jones Agwata, 'Challenges and Interventions in Sanitation Management Approaches in Mavoko Municipality' Vol.32, (2017) p.22-23< <file:///C:/Users/High%20Court%20civil/Downloads/37192-40250-1-PB.pdf> > Accessed 9 June 2022

<sup>259</sup> Micronics Engineered Group, 2022



for reuse by the plant.<sup>260</sup> The main goal being similar to that of eco industrial parks development in Kenya mentioned by Kelvin Khisa *et al* in their work.<sup>261</sup> The goals include to reduce the rate of harmful waste discharged by industries, to safeguard the right to a safe and clean surrounding, to promote zero waste emission.<sup>262</sup> In Mavoko municipality, this method is known to be applied in residential projects where the wastewater is reduced to less harmful levels and then reused for irrigation and for cleaning purposes.<sup>263</sup>

#### **2.3.4 Discharge of effluent into sewer system and Industrial effluent treatment methods employed by industries in Mavoko**

Sewerage services in Mavoko are provided for by the Mavoko Water and Sewerage Company Limited (MAVWASCO).<sup>264</sup> Companies must acquire a licence for effluents discharge, from the body monitoring and operating the specific sewage system into which they intend to discharge the effluents.<sup>265</sup> The sewer system in Athi River is composed of a series of gravity sewage pipes that empty into a sewage pump station through a 225mm concrete main sewer.<sup>266</sup> Under MAVWASCO there are also various sewer lines that were to be constructed through partnerships, which include the Public Private Partnership unit (PPP) and the Lukenya sewer lines.<sup>267</sup> Some industries in Mavoko are connected to the sewer line which discharge through the main sewage pump; for developers whose projects are not connected to any sewer system, such use pit latrines and septic tanks.<sup>268</sup> A good example is the Grain Bulk Handling Terminal (GBHL) at Athi River, which the project proponents opted to establish pit latrines for temporary

<sup>260</sup> Ibid (n202)110

<sup>261</sup> Khisa, K., Oguge, N., & Obiero, S. A. (2018). Mainstreaming the culture of eco-industrial parks (EIPs) in Kenya for the sustainable realization of the country's vision 2030. *Journal of International Business Research and Marketing*, 3(6), 7-21.

<sup>262</sup> Ibid.

<sup>263</sup> Environmental Impact Assessment study report for the proposed Lancet village on plot no. Mavoko town block 2/19052 at katani, Mavoko Sub County, Machakos County, p.18

<sup>264</sup> See in Mavoko Water & Sewerage Company Ltd <<https://www.mav-water.org/services/sewer>>accessed 14 May 2022

<sup>265</sup> EMCA Sec 75.

<sup>266</sup> Mavoko Water & Sewerage Company Ltd, < <https://www.mav-water.org/services/sewer> >accessed 14 May 2022

<sup>267</sup> As per Section 8 of the 2013 PPP Act, the PPP Unit is a Specialized Unit within the National Treasury. The PPP Unit's special duty is to aid each contracting authority in the selection, evaluation, approval, negotiation, and monitoring of PPP projects across their entire cycles. <[Kenya PPP Platform \(pppunit.go.ke\)](http://kenya.pppplatform.gov.ke) >accessed 11 June 2022

<sup>268</sup> A good example is shown by the Grain Bulk Handling Terminal (GBHL) at Athi River which opted to switch into commissioning of pit latrines as a response to the fact that the project was not connected to any sewer system. See at EIA-1635 Grain Bulk Athi River Terminal (SR-1598)-mini pdf, (September 2019)48< [https://www.nema.go.ke/Docs/EIA\\_1630-1639PDF](https://www.nema.go.ke/Docs/EIA_1630-1639PDF)> 12 May 2022

use, since the industry was not connected to any sewerage system.<sup>269</sup> However, the sewerage systems are inadequate and hence the need for creation of partnerships to extend sewerage coverage and the cost for such extensions to be shared between several developers through the partnerships.

For a successful management of industrial effluents, there is need for an industrial discharge effluents collection system.<sup>270</sup> This is to avoid such wastewaters from being released into the environment in their untreated form, which could cause ecological damage, and to divert them to the necessary place, which is a wastewater treatment facility.<sup>271</sup> Therefore, industries must come up with effluent pre-treatment systems before discharging it into the environment.<sup>272</sup>

The general procedure for wastewater treatment begins with the industrial waste being sieved, removal of grift, neutralization, aerobic (with oxygen) and anaerobic (without oxygen) reactions, sedimentation and finally to discharge.<sup>273</sup> Comprehensively the process starts with total treatment, at this stage effluent from industries is treated, then to pre-treatment stage where insoluble particles are removed before reaching the main treatment stage so as to prevent such particles from hampering with the treatment process.<sup>274</sup> It then goes to primary treatment where suspended solids are removed by coagulation, then to secondary treatment where chemicals are reduced by aerobic and anaerobic reactions into sludge.<sup>275</sup> Lastly it goes to the tertiary treatment where residual components such as colors and sludge remains are removed resulting into a clear water with the specified environmental standards required.<sup>276</sup>

The sewage treatment facility at Mavoko is situated along the River Athi's Export Processing Zone (EPZ). The treatment plant is mainly to reduce pollutants discharged into River Athi through the sewage and industrial effluent discharged.<sup>277</sup> The treatment facility in EPZ treats

<sup>269</sup> Ibid

<sup>270</sup> Juma Lillian Adhiambo, 'WasteWater Management: A case of reducing wastewater release into environment in Mathare North, Nairobi County' (2014) p.21

<sup>271</sup> Ibid

<sup>272</sup> EMCA Sec 75.

<sup>273</sup> Phil.bettary, 'Waste water treatment plants: Design and operation aspects, (November,2017) <[Presentation Template \(sia-toolbox.net\)](#)>accessed 11 June 2022

<sup>274</sup> *ibid*

<sup>275</sup> Environmental Protection Agency, 'How waste treatment works, Office of water; (May 1998) p. 5

<sup>276</sup> Ibid.

<sup>277</sup> Nadir, S., Tole, M., Dharani, N., & Wafula, G. (2020). Effectiveness of a Wastewater Treatment Plant located at EPZ in reducing Pollutants Discharged into River Athi, Kenya. p. 2

sewage using anaerobic respiration and the pond method; the facility includes three concurrent cycles and four anaerobic ponds with a combined capacity of 3,239 cubic meters.<sup>278</sup> A box drain that is 1.2 meters by 1.2 meters in size has also been installed from the EPZ to transport effluent for purification. The final effluent is dumped into River Athi with very low drainage after being transported through exhausters into the plant's inlet chamber.<sup>279</sup> However, this plant still is inefficient for treatment of chemical waste like phosphorus and heavy metals like lead, mercury and selenium especially in the rainy season.<sup>280</sup> Furthermore, whereas the plant was originally put up only for the industries within the EPZA, the waste treatment plant serves residential, commercial and industrial effluent from industries outside the EPZA as well. This is clear from its Effluent Discharge Application Form as well.<sup>281</sup> As earlier noted, the EPZ waste treatment plant is neither adequate nor efficient in treating waste water to the required standards. It is also not clear how the sludge that remains thereafter is disposed of or managed. The sludge from the waste water treatment is to be properly treated by first removing water from it, to make it valuable for use as fertilizer for agricultural purposes.<sup>282</sup> However, this plant still is inefficient for treatment of chemical waste like phosphorus and heavy metals like lead, mercury and selenium especially in the rainy season and therefore a conclusion can be drawn that this treatment plant does not treat pollutants to the required standards.<sup>283</sup>

It is quite clear that there is need to allocate enough funds to MAVWASCO. Conversely, MAVWASCO can come up with innovative ways such as creating partnerships to enable it undertake sewerage coverage and networks, so as to deal with the deficiencies experienced currently. With the help of these alliances, the public utilities may address problems impacting the water, wastewater, and waste management sector, such as incompetence, mismanagement, and a lack of funding, and the water and sanitation sector's access to services could be

<sup>278</sup> Ibid page 3

<sup>279</sup> Ibid

<sup>280</sup> Ibid page 7

<sup>281</sup> Available at <<https://epzakenya.com/water-sewerage/>> accessed 1 November, 2022.

<sup>282</sup> Mbugua Paul Karanja, Suitability of Waste Water Sludge for Agricultural Use: a case study of Ruai Sewage Treatment Plant, Nairobi, Kenya, January 2015. Page 11,

<sup>283</sup> Nadir, S., Tole, M., Dharani, N., & Wafula, G. (2020). Effectiveness of a Wastewater Treatment Plant located at EPZ in reducing Pollutants Discharged into River Athi, Kenya.

expanded.<sup>284</sup>Such engagements –public private partnerships- seem to have worked out well in China.<sup>285</sup>

### ***Challenges***

Since the town's early phases of development, the quick industrialization in Mavoko municipality has caused an explosive rise of slums surrounding key locations near to industries and other centers of employment.<sup>286</sup> Due to improper waste management practices, it should be mentioned that factories are both significant providers of employment and the primary contributor to environmental contamination in the community. Comprehensively the major constraints that came up as a result of industrial development in Mavoko may be said to include; institutional failure, high demand for fresh and safe water, sanitation and poor effluent management and waste collection.<sup>287</sup> The major one is water pollution caused by uncontrolled industrial effluents, unmonitored industrial pollution agents and lack of technical staff to remedy the mentioned challenges.<sup>288</sup> The major challenges are precisely discussed below.

### **Water pollution**

It is a fact that Mavoko has been experiencing an increased demand for fresh and safe water before devolution. Due to industrial toxic waste discharge into activated sludge and rivers, which renders water unfit for reuse and for home use, people of Mavoko sub-county still have restricted access to clean drinking water even after devolution.<sup>289</sup> In 2006 almost 10% of the residents were depending on water from the river Athi which was highly polluted.<sup>290</sup> The same was observed by Julian Mutua and Jones Agwata in their self-sponsored research done in 2017.

<sup>284</sup> Keremane, G. (2011). Public private partnerships in urban wastewater management: The Adelaide experience and lessons for Developing Countries. *Economic Journal of Development Issues*, 34-50. 10.3126/ejdi.v13i0.7207.pg 35

<sup>285</sup> Hou, X. (2022). Can Public–Private Partnership Wastewater Treatment Projects Help Reduce Urban Sewage Disposal? Empirical Evidence from 267 Cities in China. *International Journal of Environmental Research and Public Health*, 19(12), 7298.

<sup>286</sup> *supra* (n 202)121

<sup>287</sup> Machakos County Integrated Development Plan, 2018-2022 p. 31

<sup>288</sup> *ibid*

<sup>289</sup> Juliana Mutua & Jones Agwata, 'Challenges and Interventions in Sanitation Management Approaches in Mavoko Municipality' Vol.32, (2017) p.22-23 < <file:///C:/Users/High%20Court%20civil/Downloads/37192-40250-1-PB.pdf> > accessed 9 June 2022

<sup>290</sup> Un-Habitat, 'Mavoko Urban Sector Profile,' (2006)4 < Kenya: Mavoko Urban Profile | UN-Habitat (unhabitat.org) > accessed 21 April 2022

<sup>291</sup> It was generally observed by John Omung'ala in his thesis<sup>292</sup>, who also cited the observations of Budambula and Mwachiro (2005), who claimed that huge oil tankers, road, railroad, and marine disasters, as well as industrial emissions, wastewater, agricultural residues, fertilizers, leakages from various wastes, are the principal causes of water contamination.<sup>293</sup> The Machakos County Integrated Development Plan of 2018-2022, also shows that the quality of water is compromised by discharging industrial wastes into the rivers up streams. <sup>294</sup> Toxic waste dumping into rivers adversely impacts marine life and the quality of agricultural crops produced by irrigated farming along rivers in Machakos County. <sup>295</sup> Industrial effluents rich in heavy metal ions, which are among the waste produce for many industries like the chemical and hides industries are known for causing cancer, renal dysfunction, paralysis, diarrhea, stomatitis among other harmful diseases to human being.<sup>296</sup>

Sieving from the general causes of water pollution analyzed above, we can conclude that in Mavoko (Athi River) water pollution has a broad range of root causes. This includes industrially discharged effluent, poor waste management and municipal wastewater, inadequate sewer network coverage, malfunctioning conventional sewer system, inadequate wastewater reuse and inadequate waste treatment at the oxidation ponds.<sup>297</sup> Also MAVWASCO has recently been accused of discharging untreated sewage from one of their plants into the river. <sup>298</sup> Furthermore, WRA in 2015,<sup>299</sup> reported that the sewer systems in Athi River town are not preserved, which pollutes River Athi.<sup>300</sup>

### **2.3.5 Poor sanitation and effluent management infrastructure**

This results from malfunctioning conventional sewer system, inadequate sewer network coverage, inadequate treatment at the oxidation ponds and the E.P.Z.A had not ventured into

<sup>291</sup>supra (n.297)

<sup>292</sup>supra (n 262)7

<sup>293</sup> Ibid

<sup>294</sup>Machakos County Integrated Development Plan, (2018-2022)33.

<sup>295</sup> Ibid page 31

<sup>296</sup> Kosgey, J., Koech, J., Bunyasi, S., Kipkemoi, B., Muthoka, T., & Nyabaro, O. (2015). Determination of Heavy Metals Pollutants in Sediments along the Banks of Athi River Machakos County, Kenya.

<sup>297</sup> Juliana Mutua & Jones Agwata, 'Challenges and Interventions in Sanitation Management Approaches in Mavoko Municipality' Vol.32 (2017) p.22-23< <file:///C:/Users/High%20Court%20civil/Downloads/37192-40250-1-PB.pdf> > 9 June 2022

<sup>298</sup>NEMA, Factories closed, owners arrested for polluting environment

<sup>299</sup> WRMA Performance Report 5, Published by Water Resources Management Authority (October, 2016) p.6

<sup>300</sup>Ibid

recycling wastewater and lastly poor design of sanitation management approaches.<sup>301</sup> A research by Juliana Mutua, showed that a larger area of Mavoko has no sanitation services.<sup>302</sup> For example a group of 138 industrial owners were interviewed, and 125 out of them were found to be using the same sewer system which is very old and this has led to blockages and overflow to water sources.<sup>303</sup> Furthermore, Mavoko and Machakos only had two sewer lines each. The Mavoko town's current sewerage system is also about 60 years old, with a total length of 31.07 km, and serves barely 1% of the town's 943 km.<sup>304</sup> The Shit Flow Diagram (SFD),<sup>305</sup> report noted that there are only two jurisdictions that supply water waste services in Mavoko namely; the Mavoko Water and Sewerage Company (MAVWASCO) and the Export Processing Zone Authority (E.P.Z.A), which are insufficient for the rapid industrial growth of Mavoko town.<sup>306</sup> This shows that sanitation is not well-organized in Mavoko ever since 2006.<sup>307</sup>

This is because most industries still direct their untreated industrial effluent to the water sources instead of discharging into sewer systems.<sup>308</sup> This contravenes the requirement by the Water Quality Regulations 2006 which prohibit any person from causing water contamination.<sup>309</sup> The law forbids releasing any wastewater into the ecosystem from sewer treatment facilities, businesses, or other sources unless they have a NEMA-issued effluent discharge license that is in good standing and has been treated before being released into a public sewer line.<sup>310</sup>

Another example of a scenario is one where the management board visited EPZA in Athi River led by the then chairman for NEMA, John Konchellah. They discovered that most companies in EPZA routed their wastewaters into River Athi because "the sewage line being operated by the

<sup>301</sup>supra (n 305)

<sup>302</sup>ibid.

<sup>303</sup> Ibid

<sup>304</sup> Antje Heyer, Leonie Kappauf. SFD report (2018) p. 5-7

<sup>305</sup> The Shit Flowing Diagram (SFD) was first introduced in Indonesia to improve urban sanitation. An SFD provides a comprehensive picture of the difficulties that arise when providing wastewater and fecal sludge management (FSM) services in a city.

<sup>306</sup>Antje Heyer, Leonie Kappauf. SFD report (2018) p. 5-7

<sup>307</sup>. UN-Habitat, Mavoko Urban Sector profile(2006) p.9

<[file:///C:/Users/High%20Court%20civil/Downloads/2789\\_alt.pdf](file:///C:/Users/High%20Court%20civil/Downloads/2789_alt.pdf)>accessed 10 May 2022

<sup>308</sup>NEMA, Factories closed, owners arrested for polluting environment

<sup>309</sup> Environmental Management and Coordination (Water Quality) Regulations, 2006 (Cap. 387)

<sup>310</sup>Environmental Management and Coordination Act. Act no 8 of 1999. Section 74.

government institution at Kinanie was malfunctioning and lacking," which is the cause of the poor sanitation in Mavoko.<sup>311</sup>

Another study that clearly shows that industries are the major contributors of poor sanitation is shown in a report by the 12<sup>th</sup> Parliament of Kenya during their 2<sup>nd</sup> session done on 29<sup>th</sup> August, 2018. The report gave a series of compiled reports on London Distillers Kenya Limited.<sup>312</sup> The report was an inquiry done to establish the extent of environmental pollution by LDK.<sup>313</sup> The results were that the industry never complied with the guidelines set by NEMA and EMCA. It was instead playing around with the guidelines by directing its effluent into River Athi causing 15,000 people to suffer silently, risks of getting skin cancer and respiratory diseases as well as other negative effects to game animals, fish, water animals and plants were noted to have increased.<sup>314</sup>

### **2.3.6 Waste & garbage collection mechanisms**

Garbage collection and disposal is another challenge in Mavoko Sub County. A good example is the report by The Star newspaper on 27<sup>th</sup> October 2020 that garbage operations were still not efficient in Mavoko Sub County. It also reported that there were criticisms directed to the Machakos County by some politicians from Mavoko Sub County, due to poor garbage collection mechanisms.<sup>315</sup> Also the Kenya News Agency further reported that residents of Mlolongo town in Athi River/ Mavoko Sub-County made some reports on the media over the increasing number of uncollected garbage bins lying in the neighborhood.<sup>316</sup> The Kenya Tribune also gave a report recently which indicated that the residents in Mavoko town were sometimes forced to look for an alternative way of disposing the solid waste.<sup>317</sup> This was following the scarcity of trucks to ferry garbage for disposal in the most important period of industrial growth.<sup>318</sup> The report also showed the fear expressed by the residents in Mavoko town, for water borne diseases owing to poor

<sup>311</sup> Ibid (n 316)

<sup>312</sup> LDK report-compressed.pdf (2019)

<sup>313</sup> LDK report-compressed.pdf (2019) 6

<sup>314</sup> Ibid

<sup>315</sup> The Star (October/27/2020)

<sup>316</sup> KNA, 'Athi River residents raise alarm over uncollected garbage bins, 7<sup>th</sup> November 2020' <[kenyanews.go.ke/tag/mavoko-sub-county/](https://kenyanews.go.ke/tag/mavoko-sub-county/)> accessed 9 August 2022

<sup>317</sup> Kenya Tribune <<https://www.kenyatribune.com/mavoko-residents-raise-the-alarm-over-poor-sanitation/>> 12 May 2022

<sup>318</sup> Ibid.

management.<sup>319</sup> The heart of this revert back to industries not taking seriously the standards and regulations put in place by NEMA and EMCA. Another example is a situation where officers from NEMA together with the residents of Kinanie were shocked when they held a tour around the river and discovered that the water had turned pink because of large amounts of pollution caused by wastewater from factories.<sup>320</sup>

### **2.3.7 Poor town planning**

Due to the high population increase and the growth of its manufacturing and industrial base, Mavoko was identified as one of Kenya's townships with the fastest population growth in 2006.<sup>321</sup> This has imposed a challenge to the Municipal Council of Mavoko (MCM) in responding to the town's physical and economic development.<sup>322</sup> There were no town-planning departments in Mavoko and hence developments were uncontrolled.<sup>323</sup> In Mavoko, the majority of industries are modern and near to residential areas, which exposes the occupants to pollution. As an example, flower farms along the Mombasa Highway are next to freshly constructed residential neighborhoods, which exposes occupants to pesticides.<sup>324</sup> Additionally, the majority of people in Mavoko reside in unsafe slums with poor sanitary environment and limited access to basic amenities.<sup>325</sup>

In conclusion, in as much as Mavoko is designated as an industrial hub, the water scarcity and water resources pollution problems will continue to be felt the more if deliberate actions are not taken to deal with the issues addressed above. Water resource conservation and /or environmental protection will continue to suffer at the expense of industrial development, where development fails to consider the environment. This will have catastrophic consequences on human, animal and plant life as it has been noted.

<sup>319</sup> Ibid

<sup>320</sup> The Standard. 2021. NEMA issues stern warning to factories discharging waste into Athi River

<sup>321</sup> Ibid (n 315)5

<sup>322</sup> Ibid

<sup>323</sup> Ibid (n 315) 9

<sup>324</sup> Machakos County Integrated Development Plan, (2018-2022) p. 31

<sup>325</sup> Ibid page 31



## 2.4 Enforcement measures in place for compliance

### 2.4.1 Legislative measures and cases

In seeking to redress the challenges, there are various regulatory frameworks provided in the legal framework laws concerning the administration of industrial waste water. The Constitution of Kenya being the top most law is very instrumental with regards to waste management. The less obligatory prelude urges preservation and protection of the environment for the benefit of future generations.<sup>326</sup> Additionally, everyone is entitled to a safe and healthy environment, both now and in the future, under the Constitution.<sup>327</sup> According to Article 69 of the Constitution, the State has responsibilities for ensuring the efficient use, and conservation of the environment. Additionally, to guarantee the efficient allocation of the benefits accumulating, to maintain tree cover, to motivate public involvement in environmental protection and management, and to stop activities that could endanger the environment.<sup>328</sup> In the **Ken Kasinga** case, it was decided that when environmental proper precautions, including the public involvement process, are not implemented, one would presume that the entitlement to a safe and healthy space is in jeopardy.

Last but not least, the Constitution permits any individual whose entitlement to a safe and clean environment is expected to be breached to claim compensation or any other relevant legal remedy in court.<sup>329</sup> The remedy can be an order to discontinue the harmful act or a compensation order like it was in the case of **KM & 9 others**<sup>330</sup> where the court held that common indemnity for annoyance Kshs.500,000 be awarded to the plaintiffs and the price of recovering the soil Kshs.267,439,464.15.<sup>331</sup> The responsible party consented to provide Kshs. 1,760,424 in financial compensation to the aggrieved parties in the matter of **Mohamed Ali Baadi v. the AG**, which the court mentioned.<sup>332</sup>

The EMCA, which is the substantive law on effluent discharge and control provides for general environmental protection from industrial effluent.<sup>333</sup> It makes a requirement for industries’

<sup>326</sup> Constitution of Kenya 2010. The preamble

<sup>327</sup> Constitution of Kenya. Article 42

<sup>328</sup> Constitution of Kenya 2010. Article 69

<sup>329</sup> Constitution of Kenya 2010. Article 70

<sup>330</sup> *KM & 9 others v Attorney General & 7 others* [2020] eKLR; < <http://www.kenyalaw.org>.>accessed 8 March 2022.

<sup>331</sup> *Ibid* page 31/33

<sup>332</sup> *Mohamed Ali Baadi vs the A.G and 11 others* eKLR. < <http://www.kenyalaw.org>. > accessed 8 March 2022.

<sup>333</sup> Environmental Act (EMCA), Environmental management and co-ordination Act, (ACT NO 8 OF 1999)

developers to first carry out Environmental Impact Assessment (EIA) study.<sup>334</sup> EIA is a process that mitigates risks, vulnerabilities, and weaknesses throughout the whole project life cycle, including planning, design, building, operation, and retirement.<sup>335</sup> Therefore it is a duty for project proponents to conduct the EIA study,<sup>336</sup> and must involve the public during the exercise,<sup>337</sup> then submit the report to NEMA. Lack of meaningful public participation will be in contravention of the Constitution, which leads to social engagement in the management, preservation and safeguarding the environment.<sup>338</sup> Consequently, should a project be implemented in want of public participation it will be challenged in courts as it was in **Peter Mugoya & another vs NEMA & 2 others**<sup>339</sup> where it was claimed that NEMA's permission of the building construction inside a community forest was improper because the project report was deficient due to the absence of significant public input and failed to specify the mitigation measures.<sup>340</sup>

NEMA is also supposed to conduct regular environmental audit<sup>341</sup> on industries.<sup>342</sup> The same was upheld during the court hearing of **Kibos Distillers Limited and 4 others v. Benson Ambuti**, in which the court also ordered the 4th respondent (NEMA) and the National Environmental Complaints Committee (NECC) to undertake continuous inspection on the three complainants' processing plants to ensure that it complies with the environmental laws, and the three complainants should undertake an environmental audit of their programmes and initiatives once a year and submit reports to the 4th respondent.<sup>343</sup> Another key requirement is the Strategic Environmental Assessment (SEA) to be done before an industry is constructed and it should

<sup>334</sup> Ibid, Section 58

<sup>335</sup> Ibid

<sup>336</sup> Ibid (n 344)

<sup>337</sup> Constitution of Kenya 2010. Article 69(d)

<sup>338</sup> Ibid

<sup>339</sup> Peter Mugoya & another vs NEMA & 2 others NET appeal no.99 of 2012,

<sup>340</sup> Ibid

<sup>341</sup> An ongoing project's activities and procedures are systematically documented, periodically evaluated, and objectively assessed to see how closely they adhere to the project's approved environmental management plan and good environmental management practices. This is known as an environmental audit (EA). At all ongoing operations and decommissioning stages, a thorough EA promotes a healthy and safe environment.

<sup>342</sup> Sections 68 and 69 of the EMCA 1999

<sup>343</sup> Kibos Distillers Limited & 4 others v Benson Ambuti Adegwa & 3 others [2020] eKLR (CIVIL APPEAL NO. 153 of 2019) p.39 <<http://www.kenyalaw.org>> accessed 8 March 2022

address the pre-existing and emerging environmental concerns.<sup>344</sup> Water pollution is highly prohibited,<sup>345</sup> and it is therefore an important requirement that industries have the Effluent Discharge License (EDLs),<sup>346</sup> and to treat effluent before being discharged into the environment.<sup>347</sup> Additionally effluent should only be directed to the respective sewerage systems.<sup>348</sup>

The Water Act 2016, is also quick in protecting the water resources against industrial waste. The Act makes it a crime to pollute water resources unless authorized by the Act.<sup>349</sup>

The Physical and land use planning Act is concerned with organizing views with regard to the use, management, and control of property in Kenya.<sup>350</sup> As discussed earlier, Mavoko lacked town plans/planning committees and industries in Mavoko were located close to residential areas.<sup>351</sup> The Act requires the both levels of governments to create physical and land use plans and engage the public meaningfully in their development,<sup>352</sup> for community to raise objections on the suitability of such plans.<sup>353</sup> A developer is therefore expected to seek authorization from the applicable county jurisdiction before making any development, failure of which they will be subjected to criminal sanctions or even have the unapproved work demolished.<sup>354</sup> The Act also highlights the need to guarantee that all land activities adhere to the policy directives set by the planning authority, as well as to safeguard the environment and advance safety of the public.<sup>355</sup>

<sup>344</sup>Legal Notice No. 101 of June 2003; (Kenya Gazette Supplement No. 56, Legislative Supplement No. 31) of 13th June, 2003. The fourth chapter examines how effectively NEMA has implemented the legal ErA obligations.

<sup>345</sup>EMCA. Sec 72

<sup>346</sup>Ibid, Section 75(4)

<sup>347</sup>Ibid, Section 74

<sup>348</sup>Ibid. Section 72&74

<sup>349</sup> Water Act 2016. Section 108

<sup>350</sup> The Act's objectives are outlined in Section 3 and include, among other things, the management and administration of physical and land use planning in Kenya, the processes and standards for land development and the regulation of physical planning and land use, a mechanism for resolving disputes, and a framework for equitable and sustainable development.

<sup>351</sup>. UN-Habit, 'Mavoko Urban Sector profile'(2006)P.

6<[file:///C:/Users/High%20Court%20civil/Downloads/2789\\_alt.pdf](file:///C:/Users/High%20Court%20civil/Downloads/2789_alt.pdf)>accessed 10 May 2022

<sup>352</sup> Physical and Land Use Planning Act no.3 of 2019. Section 40

<sup>353</sup> Ibid. Sections 14-19

<sup>354</sup> Ibid, Section 57

<sup>355</sup> Ibid, Part IV, section 55(1)

The Physical Planning Act also vests in the planning authorities a responsibility to ensure proper planning of the municipal at large.<sup>356</sup>

#### **2.4.2 Provision of Effluent Discharge License & Permit and Revocation of Licenses & Permit**

NEMA in enforcing the requirement for Effluent Discharge License (EDLs) can cause the arrest of a project proponent who intends to discharge waste to the environment without first acquiring the EDL which ensures that the wastewater discharged is first treated and the discharge to be safe as per section 75(1) of EMCA. This provision does not apply to proponents who have obtained the EIA license and discharges effluent into septic tanks.<sup>357</sup>

The National Environmental Tribunal is also quick in ensuring that regulations set by EMCA are adhered to by revoking any license issued by NEMA without considering the regulations thereto. An example of this was reported by The Star on 26<sup>th</sup> July, 2016 when the National Environmental Tribunal revoked the license issued to Malindi coal plant.<sup>358</sup> The tribunal revoked the license on the basis that NEMA failed to consider its mandate as required by the law before issuing the license. NEMA gave an impugned environmental and social assessment license to Amu Power Company Ltd. NEMA illegally approved the project for there was no evidence showing that the project was advertised.<sup>359</sup>

The Water Act also has precise ways to handle wastewater.<sup>360</sup> The Act establishes the Water Regulatory Authority (WRA) under section 11 which acts as the agent for the national government in the administration and utilization of water resources.<sup>361</sup> The WRA is in charge of creating the requirements for conservation of water resources, enforcing those guidelines by issuing licenses.<sup>362</sup> It also ensures monitoring compliance with the state of the licenses.<sup>363</sup> The license issued can be withdrawn or differ from the WRA or by the county government on advice

<sup>356</sup> Ibid, Section 78

<sup>357</sup> Republic v NEM) & 2 others; Ex-Parte Misty Mountain Lodge Ltd & another [2020] eKLR, (argued this in the Miscellaneous Judicial Review no.6 of 2019 at fact 8 and the court upheld it)

<sup>358</sup> P.Wanamansi. *Lamu coal plant project license revoked by tribunal*, Star News, 2019.

<sup>359</sup> Ibid

<sup>360</sup> Water Act 2016. Section 6

<sup>361</sup> Ibid, Sec12

<sup>362</sup> Ibid, Sec 12(d)

<sup>363</sup> Water Act section 13

of the Basin Water Resource Committee.<sup>364</sup> The variation can conform to altering the discharge or standards of water,<sup>365</sup> revocation because the license's contract terms weren't followed.<sup>366</sup> This shows that the permit is not absolute. It is also worthy to recognize the fact that the Act is also equipped to control trade effluent to promote proper handling of trade effluent to make sure that the effluent does not pollute the environment or cause any harm to human health.<sup>367</sup>

### 2.4.3 Courts of law

Courts are expected to maintain the right to a safe and clean environment under Article 47, and to enforce the rules on waste disposal. Following the latitude issued to every individual to approach the court if the right under Article 47 is likely or is being violated, courts can make orders such as compensation of such a victim, restoration orders and orders to discontinue the harmful act.<sup>368</sup>

As a result, the courts have been able to issue some truly remarkable judgements, such as that in **KM & 9 others**, where the 8th respondent leased a nearby property to the 7th respondent, who built a business to recycle lead-acid batteries. More than 20 people died due to lead poisoning when the factory's toxic waste leaked into the community and caused the petitioners' numerous illnesses and afflictions.<sup>369</sup>

The plaintiffs should receive consequential damages for annoyance in the amount of Ksh. 500,000, the court held (citing Mohamed Ali Baadi vs the A.G and 11 others)<sup>370</sup>, a mandatory injunction requiring the plaintiff to use drainage channels with impermeable lining to divert any rain water that occurs on the defendant's property from the plaintiff's property.<sup>371</sup> The plaintiff was also awarded Kshs.267, 439,464.15, the expense of the lawsuit, the counterclaim, as well as an affirmation of the applicants' rights.<sup>372</sup>

<sup>364</sup> Ibid, Sec 27

<sup>365</sup> Ibid, Sec 46

<sup>366</sup> Ibid, Sec 49

<sup>367</sup> Ibid, Sec 108

<sup>368</sup> Constitution of Kenya 2010. Article 70

<sup>369</sup> Ibid at page 1

<sup>370</sup> (2018) eKLR, where the project proponents agreed to give Kshs. 1,760,424 in financial compensation to those who were impacted <<http://www.kenyalaw.org>>accessed 8 March 2022.

<sup>371</sup> KM & 9 others v Attorney General & 7 others [2020] eKLR p. 31/33

<sup>372</sup> Constitution of Kenya 2010. Articles 26,42 and 43 on the right to life, and the right to the highest attainable standard of health care and sanitation.

In **Kibos Distillers Limited**,<sup>373</sup> according to the NECC report (5th October 2017), the respondents were dumping raw wastewater into the Rivers Nyamasaria, Kibos, and Lie Lango. The first to the third respondents were releasing raw wastewater from their distillery, called vinessa, into the environment.<sup>374</sup> The ELC made a ruling and issued a ruling holding that the first, second, and third defendants had proven their case against the appellants, granting the relief and declarations of rights requested by the respondents.<sup>375</sup>

The appellate court also directed NEMA and NECC to conduct inspections on the three factories. The three respondents were to perform yearly environmental audits of their operations and submit the findings to the fourth respondent (NEMA), to ensure compliance with environmental legislation in future.<sup>376</sup>

The courts as tools for ensuring compliance will be considered at length in the next chapter.

#### **2.4.4 Closing of industries and arresting of project proponents**

This method has been applied in some places in Mavoko sub-county to ensure compliance with the guidelines set by NEMA and EMCA for effluent management, a good example was reported by Victor Nzuma in 2021 in *The Standard*.<sup>377</sup> The report showed that NEMA had issued a stern warning to industries that discharged their raw effluent into River Athi, this was after NEMA officials toured some parts of the river in response to residents out-cry and found that water had turned pink due to pollution.<sup>378</sup>

Dr. Alfred Mutua - the then Governor of Machakos County- was also cognizant of the fact that closing of industries causing pollution can be an outstanding measure for ensuring compliance with the standard regulations for effluent management. He gave a one-month ultimatum on November 2018 for industries dumping waste into River Athi to stop or be shutdown.<sup>379</sup>

<sup>373</sup>Kibos Distillers Limited & 4 others v Benson Ambuti Atega & 3 others [2020] eKLR (CIVIL APPEAL NO. 153 of 2019) <<http://www.kenyalaw.org>>accessed 8 March 2022

<sup>374</sup>Ibid

<sup>375</sup> Constitution of Kenya 2010. Article 42, the right to a clean and healthy environment

<sup>376</sup>Ibid (n 382)37

<sup>377</sup> Victor Nzuma, 'NEMA issues stern warning to factories discharging waste into Athi River,' (2021)

<sup>378</sup>Ibid

<sup>379</sup> *Industries in Mavoko dumping waste in Athi River to be closed*, Kenya News Agency, November 30, 2022

Factories in the EPZ accused of causing environmental pollution by discharging effluent contrary to the requirements set by the Water Quality Regulations 2006 and those that were releasing wastewaters into the sewage without purification systems, were inspected and some factory owners were arrested following the allegations as a way to ensure compliance with the Water Quality Regulations 2006.<sup>380</sup>

Another scenario was on the shoe factory where six managers were arrested after they failed to turn up in court to respond to accusations of pollution of River Athi. The plant was shut down immediately after the arrest of the six managers.<sup>381</sup>

#### **2.4.5 Conducting regular Environmental Audits on projects**

Environmental Audits (EA) show the extent of compliance alongside the activities expressed in the EIA issued in line with section 58(2) of EMCA.<sup>382</sup> Both existing and new ventures must undertake environmental impact assessments and environmental audits since these procedures are used to gauge a project's level of compliance with the applicable rules.<sup>383</sup> It is a duty for the project proponents to conduct annual environmental audits of their projects and ventures and present the findings to NEMA, which is to also conduct regular inspection to make future adherence to environmental regulations a priority.<sup>384</sup>

### **2.5 Conclusion**

Mavoko and Kenya in general is still lagging behind when it comes to effective wastewater or industrial effluent management. The existing legal framework for environmental management is very old, talk of EMCA of 1999 and the Water Quality Regulations 2006. The old regulatory framework needs to be updated to suit current development and to promote effective effluent management. Institutional failure and inadequate awareness together with inadequate funds, hamper the effective implementation of the regulations on effluent management.

<sup>380</sup> *Factories closed; owners arrested for polluting environment*, Kenya News Agency.

<sup>381</sup> Bernardine Mutanu, 'Mavoko shoe factory managers arrested over pollution of Athi River (1<sup>st</sup> May 2019)

<sup>382</sup> Environmental Management and Co-ordination Act of 1999. Section 69

<sup>383</sup> *Ibid.* Section 58 of EMCA, 2<sup>nd</sup> schedule 9(i).

<sup>384</sup> *Ibid* (n 382)37

It is therefore important for the Mavoko sub county to sanitize the various institutions, including the town planning authority, to come up with the best measures to ensure that the manufacturing industries and other industries do not discharge industrial effluents into water resources. Lastly, NEMA should enlighten project proponents on industrial symbiosis for them to exchange waste or buy-product and on the various modes of waste utilization and recycling of wastewater.



### **3.0 CHAPTER THREE: THE LEGAL AND INSTITUTIONAL FRAMEWORK FOR INDUSTRIAL WASTE WATER GOVERNANCE IN KENYA: REVIEWING THE REGULATORY FRAMEWORK FOR INDUSTRIAL WASTE WATER IN KENYA**

#### **3.1 Introduction**

Clean water is in short supply in Kenya. Only 42.1 BCM/year of natural sources of water are available in the country.<sup>385</sup> These findings indicate decreasing water availability in the country.<sup>386</sup> Yet in as much as fresh water is a scarce resource in Kenya, the same is vital for most if not all industrial processes. Yet industrial development is seen as among the biggest factors in enabling Kenya realize her Vision 2030 and particularly the economic pillar. It then becomes paramount for the country to set up deliberate measures through its regulatory and policy framework, to ensure that industrial waste is reduced and waste water is recycled and reused by industries. The measures must as well ensure that effluent from industries is managed in a sustainable manner while conserving and preserving the environment. This chapter delves into the regulatory tools: policies and laws that Kenya has established for the management of industrial effluents, as well as the institutions tasked with its regulation. The chapter reviews the legislation as well as regulations enacted to aid the implementation of laws governing the purification and release of industrial waste water. Furthermore, the chapter reviews some of the case laws relevant to the instant subject of study. The aim is to assess and determine whether Kenya's regulatory system adequately works to prevent water pollution resulting from industrial effluent discharge. This study will also assess if the same adequately promotes or is aligned to the industrial symbiosis or circular economy theory and integrates the stability of scrutiny advanced by the continuous management concept. Additionally, the regulatory tools are assessed to verify sufficiency in guaranteeing compliance with the established laws and ascertain the possible causes of poor implementation.

<sup>385</sup> NEMA; Kenya State of the Environment Report 2019-2021, pg xvii.

<sup>386</sup> Ibid.

## **3.2 The Legal, Policy and Institutional Framework**

Industrial wastewater contributes a fair percentage of the total cause of environmental pollution and destabilization of natural balance also known as environmental degradation. This section delves around the specific laws, regulations and institutions entrusted with the mandate to ensure the treatment and secure discharge (control) of industrial wastewater. The primary objective is to sort between the conflicting interests, which are each nation's legitimate right to prosperity and to a pristine, healthy ecosystem.<sup>387</sup> The increase in industrial wastewater results from the rapid industrial growth in Kenya. The laws and regulations that will precisely be addressed under this section tend to ensure that development or industrial growth is sustainable. This is due to the fact that any economic growth must be self-sustaining in order to ensure proper environmental regulation.<sup>388</sup>

### **3.2.1 Governance of Industrial waste water and its implication on the environment**

The social equality, efficacy, and sustainability of environmental use and preservation are significantly influenced by governance.<sup>389</sup> It can be described in the context of natural resources as the standards, and organizations that establish how authority over those resources are exerted, and how citizens are involved in and benefit from those resources.<sup>390</sup> It is clear from the definition that governance of natural resources would involve a number of stakeholders ranging from the state and its various actors or agencies, to the government and corporate sectors as well as the citizenry.

A number of concepts have been developed over time to aid in the governance of natural resources. Concepts such as sustainable development which have been adopted by international environmental instruments are one example. The SDGs on different issues were created as a result of this notion, which aims balance between the use of resources and growth of the economy. These issues range from ending or eradicating poverty, ensure availability of clean water and sanitation, promote sustainable industrialization, ensure equitable systems of production and consumption, environmental conservation, etc. Other important concepts adopted

<sup>387</sup> Stockholm declaration 1972

<sup>388</sup> The UNCED report (Our common future) 1987

<sup>389</sup> Springer J *et al* The Natural Resource Governance Framework; Improving Governance for Equitable and Effective Conservation, (2021) p. 1.

<sup>390</sup> *Ibid*, page 3.

internationally in response to natural resources use and economic growth include economically sustainable development, industrial symbiosis and cyclic economy to mention a few. These concepts were considered at length in chapter 1 as they also form the theoretical framework of this thesis.

In relation to this study, maintenance of water resources is important for the environment as our country will continue to be based on natural resources.<sup>391</sup> Natural resources also support over 70% of people's livelihoods.<sup>392</sup> Thus failure to govern our natural resources has dire consequences on us as a people and individually. It would lead to poverty and poor quality of living. Further, it need not be stressed that water is life. The continued increase of populations and growth of industries has put immense pressure on fresh water resources. These comes with challenges such as over exploitation and pollution of such resources that need to be managed. These can lead to consequences on health such as risks of cancer, water borne illnesses, loss of livelihoods, loss of biodiversity, loss of lives etc as largely elaborated in chapter 2.

Since institutions and procedures intended to promote openness, the principle of law, transparency, openness, and inclusivity are considered to be part of governance;<sup>393</sup> then if we talk about governance of industrial wastewater, we refer to the norms, the legal instruments and the institutions that govern the management of industrial wastewater. Kenya as a country undertakes governance of industrial wastewater through the Constitution as the *grund norm*, legislations, regulations, policies and institutions tasked with the implementation of the laws, which will be discussed in detail in this chapter.

The Constitution is one of the most critical instruments in environmental resource governance following its explicit environmental conservation clauses.<sup>394</sup> The Constitution addresses the need for sustainable utilization of environment, then goes further and incorporates the need for public participation<sup>395</sup> which urges the public to actively participate in environmental issues.<sup>396</sup> This means that the entitlement to a healthy environment is threatened by the isolation of the

<sup>391</sup> NEMA; 'Kenya State of the Environment Report' (2019-2021) p. xiii.

<sup>392</sup> Ibid, page xv.

<sup>393</sup> UNESCO, International Bureau of Education; 'The concept of governance.' 2

<sup>394</sup> Florence Korir Chebet, 'Discharge of Industrial Effluents in Kenya: Adequacy and Implementation of the Laws'.

<sup>395</sup> Constitution of Kenya 2010. Article 10

<sup>396</sup> Muigua Kariuki, 'Nurturing our environment for sustainable development,' Glenwood Publishers Ltd, (September 2016) Nairobi-Kenya.P.63

public from environmental and natural resource issues.<sup>397</sup> The entitlement to a safe and clean environment as established by the Constitution,<sup>398</sup> was also held to be a human right, by the Inter-American Court of Human Rights.<sup>399</sup> The State is to also encourage activities such as Environmental Impact Assessment,<sup>400</sup> Environmental protection and the abolition of functions and procedures that threaten the environment depend heavily on environmental audits, surveillance, and public engagement.<sup>401</sup> In *Council of Governors and 3 others v. Adrian Kamotho Njenga*, the court ruled that the Constitution guarantees everybody the right to have the environment protected through the actions outlined in Article 69.<sup>402</sup> As determined by the Inter-American Court of Human Rights, if the State permits the project proponents to conduct an action without recognizing civil rights, this will be a violation of the State's obligation to defend human rights.<sup>403</sup> Upon filing of a legal complaint, the court can give remedies which may include but not limited to giving orders to discontinue the harmful activity and compensation to the victim of the violation.<sup>404</sup> In *KM & 9 others vs The Attorney General & 7 others*<sup>405</sup> the 7th respondent built a facility for recycling lead-acid batteries on a block of land that the 8th respondent leased to them. More than 20 people died of lead poisoning when the factory's toxic sludge leaked into the community and caused the petitioners' numerous ailments and afflictions.<sup>406</sup>

'The plaintiffs should receive Ksh.500,000 in civil penalties for annoyance', the court ruled<sup>407</sup>, a compulsory injunction requiring the defendant to use drainage channels with impermeable lining to divert any water that originates on the defendant's property.<sup>408</sup> The plaintiffs were also given a

<sup>397</sup> Ken Kasinga vs. Daniel Kiplagat Kirui & 5 others 2015 eKLR

<sup>398</sup> Article 42

<sup>399</sup> Inter-American Court of Human Rights Concerning the Interpretation of Article 1(1), 4(1) and 5(1) of the American Convention on Human Rights OC-23/17

<sup>400</sup> In *Kibos Distillers Limited & 4 Others v. Benson Ambuti Adegwa & 3 Others* [2020] eKLR (CIVIL APPEAL NO. 153 of 2019),

<sup>401</sup> Constitution Of Kenya 2010. Article 69

<sup>402</sup> [2020] eKLR, Environment and Land Petition 37 of 2017

<sup>403</sup> In *Judgement of Velasquez Rodriguez vs Honduras* (July 19, 1988, Series C, No.4)

<sup>404</sup> Constitution of Kenya 2010. Article 70

<sup>405</sup> *KM & 9 others v Attorney General & 7 others* [2020] eKLR <<http://www.kenyalaw.org>> accessed 8 March 2022.

<sup>406</sup> *Ibid* page 1

<sup>407</sup> (2018) eKLR, <http://www.kenyalaw.org>, last visited on 8 March 2022.

<sup>408</sup> *KM & 9 others v Attorney General & 7 others* [2020] eKLR, p. 31/33

declaration of their rights by the court, as well as Kshs. 267, 439,464.15 in charges for soil repair, legal fees, and court costs.<sup>409</sup>

In *Kibos Distillers Limited*,<sup>410</sup> according to NECC, the appellants were harming the environmental area by dumping raw wastewater into the rivers. The appellants were releasing raw effluent from their distillery, called vinessa.<sup>411</sup>

The ELC made a ruling holding that the first, second, and third respondents had proven their case against the appellants, granting the relief and assertions of rights requested by the respondents.<sup>412</sup>

The appellate court also directed<sup>413</sup> the three appellants to perform annual environmental assessment of their activities and projects and present a report to the fourth respondent (NEMA), to perform continuous inspection on the three appellants' factories to oversee adherence to quality standards and to ensure future compliance with environmental regulations.<sup>414</sup>

The two cases above affirm some of the measures that the court is empowered to direct or order under the Constitution with regards to environmental protection.<sup>415</sup>

The purpose of the EMCA is to establish effective regulatory and administrative approach to the management of the environment.<sup>416</sup> Anne Angenyi in her work noted that EMCA was enacted to remedy deficiencies. Such deficiencies include lack of provisions in law for project assessment to mitigate their adverse environmental consequences and sufficient penalties for perpetrators of pollution.<sup>417</sup> The Act makes tremendous provisions on effluent discharge, including but not limited to the requirement of a valid Effluent Discharge Licenses (EDLs), which is to be issued

<sup>409</sup> Constitution of Kenya 2010. Articles 26,42 and 43.

<sup>410</sup> *Kibos Distillers Limited & 4 others v Benson Ambuti Atega & 3 others* [2020] eKLR (CIVIL APPEAL NO. 153 of 2019) <<http://www.kenyalaw.org>> accessed 8 March 2022

<sup>411</sup> *Ibid*

<sup>412</sup> constitution of Kenya 2010. Article 42,

<sup>413</sup> According to Section 31 of the EMC Act of 1999, NECC was created. Its name was modified in the EMCA (Amendment) No. 5 of 2015 from the Public Complaints Committee (PCC). It is a crucial institution in Kenya's evaluation of the state of the environment. It is crucial in the facilitation of tools for alternative conflict settlement in relation to environmental issues. NECC advises the Cabinet Secretary, making a vital contribution to the creation and advancement of environmental policy.

<sup>414</sup> *Kibos Distillers Limited & 4 others...* <http://www.kenyalaw.org>.

<sup>415</sup> Constitution of Kenya 2010. Article 70

<sup>416</sup> EMCA of 1999. The preamble

<sup>417</sup> Okidi, C. O., Kameri-Mbote, P., & Akech, M. (2008). Environmental governance in Kenya: Implementing the framework law.

upon considerations by the authority to establish the effects of the effluent to water sources.<sup>418</sup> To facilitate an efficient coordinated approach to environmental management the Act establishes several organs which will be discussed in depth in this chapter.<sup>419</sup> The organs include NEMA as the main institution of the State for the execution of environmental strategies.<sup>420</sup> EMCA also initiates the County Environment Committees which enhance the decentralization of environmental management and public participation.<sup>421</sup> Other institutions under EMCA include the NECC,<sup>422</sup> and the National Environment Tribunal established to deal with appeals on granting of licenses, restoration fee among other functions.<sup>423</sup>

*The Water Act 2016* forms part of the important pieces of legislation and deals with the growth of wastewater services.<sup>424</sup> The Act establishes WRA and WASREB mandated to carry out the purpose under the Act.<sup>425</sup> The Water Act acknowledges the entitlement to a safe and clean environment<sup>426</sup> which has its basis from the Constitution<sup>427</sup> and was also recognized in the ruling of *Adrian Kamotho Njenga vs. Council of Governors & 3 others*<sup>428</sup>. The establishment of the WRA under the Act aims at modulating the control and utilization of water resources through giving out permits for discharge of pollutants into water resources.<sup>429</sup> Through the regulation of trade effluent and measures that safeguard the environment from natural destabilization, the Act further provides for the protection of the right stated in Article 69.<sup>430</sup> Under Section 108, the Act specifically requires that a person licensed by WASREB to receive effluent into his sewage system to put in place measures for proper handling of that effluent.<sup>431</sup> This is to prevent such effluent from causing pollution to the environment and from affecting human health.<sup>432</sup> There are also some regulations which deal with the issue of industrial effluents and waste management

<sup>418</sup> EMCA of 1999. Section 75

<sup>419</sup> Ibid (n 439)143

<sup>420</sup> Ibid, Sec 7 & 9(2)

<sup>421</sup> Ibid. Sec 29

<sup>422</sup> Ibid. Sec 31

<sup>423</sup> Ibid. Sec 129

<sup>424</sup> Water Act 2016. Section 3

<sup>425</sup> Ibid, Section 11 and 70 respectively

<sup>426</sup> Water Act 2016. Section 63

<sup>427</sup> Article 42

<sup>428</sup> (2020) eKLR

<sup>429</sup> Water Act 2016. Sections 12 and 36(c)

<sup>430</sup> Water Act 2016. Section 108

<sup>431</sup> Ibid

<sup>432</sup> Ibid

under EMCA and Water Resource Management rules (2021) under the Water Act. All these regulations have one common goal which is seeking to minimize waste discharge and haphazard dumping which may raise health and environmental concerns.<sup>433</sup>

### ***The Constitution***

The Constitution, as mentioned earlier, remains the most critical instrument in resource governance or management; this is due to its explicit environmental protection and conservation clauses,<sup>434</sup> some of which have been mentioned at the beginning of this chapter. The Constitution issues parliament the latitude to enact ratification relating to the surroundings,<sup>435</sup> through which some of the important institutions like NEMA, NET and WRA are established. The Constitution establishes the Environmental and Land Court,<sup>436</sup> and also spreads various functions regarding industrial wastewater management to the National and the County Governments,<sup>437</sup> which operate through the different institutions.

### ***The National Government functions***

This is obligated by Law to safeguard the environment while fostering sustainable growth.<sup>438</sup> The State must make sure that there is significant public engagement in this process.<sup>439</sup> On this note NEMA must make sure that public involvement is sufficient before granting the EIA license, as was upheld in the case of *Peter A. Mugoya vs NEMA and 2 others*.<sup>440</sup> The plaintiffs in this case contested NEMA's improper permission of the building's construction amid a community forest that featured a cultural site and a water catchment region. Among the basis of irregularities on NEMA included the failure to consult lead agencies, there were no mitigation measures and also public participation was woefully inadequate.<sup>441</sup> Additionally, the National Environmental Tribunal determined that the project proponent had improperly conducted stakeholder

<sup>433</sup> Mathew, 'Industrial Discharge in Nairobi, an analysis of regulatory environment' (2019)p. 42.<<https://ir-library.ku.ac.ke>>Accessed 18 May 2020

<sup>434</sup> Florence Korir Chebet, 'Discharge of Industrial Effluents in Kenya: Adequacy and Implementation of the Laws' <<https://su-plus.strathmore.edu/handle/11071/6189>> accessed 22 October 2021.

<sup>435</sup> Constitution of Kenya 2010. Article 72

<sup>436</sup> Ibid. Article 162

<sup>437</sup> Ibid. fourth schedule on the functions of national government

<sup>438</sup> Ibid. fourth schedule on the functions of national government

<sup>439</sup> Ibid. Article 69(1)(d)

<sup>440</sup> NET appeal no. 99 of 2012

<sup>441</sup> Peter A. Mugoya vs NEMA and 2 others (NET appeal no. 99 of 2012)

engagement and had thus deprived the stakeholder's public engagement in *Abdallah, Chairman, Donholm phase 5 Residents' Association v. Director General NEMA & another*.<sup>442</sup>

NEMA is used by the National Government as the primary State mechanism for implementing environmental policy and for general oversight and integration of environmental problems.<sup>443</sup> NEMA has the obligation to receive the Environmental Impact Assessment Study Reports from project proponents for approval,<sup>444</sup> and granting of the EIA license.<sup>445</sup> Additionally, NEMA performs environmental assessments on all operations that may have a substantial adverse environmental impact.<sup>446</sup> NEMA also monitors and assesses activities conducted by lead organizations to confirm that such activities do not bring about environmental degradation by ensuring that the right measures are adhered to.<sup>447</sup> The application of these functions was affirmed in *Kibos Distillers Limited & 4 others v Benson Ambuti Adeg & 3 others*<sup>448</sup> where the court directed NEMA and NECC to conduct inspection on the appellants. NEMA is supposed to identify the projects which require Environmental Audits or Monitoring to be conducted.<sup>449</sup> The National Government is obligated to initiate networks of environmental impact assessments (EIA), audits and observing.<sup>450</sup> These assessments are to be examined and refined by the relevant implementing agencies and organizations,<sup>451</sup> to guard against real and actual environmental pollution and degradation. NEMA is also empowered to receive application for Effluent Discharge Licenses (EDLs) from project owners or operators of industries, whose undertaking is likely to discharge or shall discharge effluent into the environment.<sup>452</sup> NEMA is then to give the EDLs and to have a register for all the EDLs issued.<sup>453</sup> Through the Water Act 2016 and WRA, the National Government is able to protect vulnerable water resources.<sup>454</sup> Functions of WRA

<sup>442</sup>Tribunal appeal no NET/38/2009 para 31&32.

<sup>443</sup> EMCA of 1999. Sec 7 & 9(2)

<sup>444</sup> Ibid. Sec58(2)

<sup>445</sup> Ibid Sec 63

<sup>446</sup> Ibid Sec 68(1)

<sup>447</sup> Ibid, Sec 9

<sup>448</sup> Civil appeal (application) 137 of 2018

<sup>449</sup> EMCA. Sec 9

<sup>450</sup> Constitution of Kenya 2010. Article 69(1)(f)

<sup>451</sup> United Nations Conference on Environment & Development Rio de Janeiro, Brazil, 3 to 14 June 1992. Agenda 21.

<sup>452</sup> EMCA, Sec 75

<sup>453</sup> Ibid, Sec 77

<sup>454</sup> Water Act 2016. Sections 12, 13



include the preservation of water in the interest of society.<sup>455</sup> These provisions work hand in hand with the section 108 of the Water Act 2016 to safeguard the ecosystem against pollution by requiring the licensee to restrict the discharge of trade effluents into sewer systems.

The National Government is required to stop all procedures and actions that could threaten the environment, and this includes taking steps to promote sustainable economic growth.<sup>456</sup> The measures may include; adequate recycling and re-using of wastewater; treatment of industrial effluents before discharging into public sewers or into water sources to remove bacterial loads and inorganic compounds; and regular testing and monitoring of chemical compounds.<sup>457</sup> This obligation also extends to ensure economic development with zero effluent emission, for example in South Africa, at the Limpopo Eco-Industrial park which aims to use plasma gasification to vaporize waste at temperatures of about 2000 degrees centigrade.<sup>458</sup>

The Constitution initiates the Environment and Land Court (ELC),<sup>459</sup> to resolve disputes that arise on the violation of the entitlement to a safe and clean environment<sup>460</sup> mentioned in the ELC Act. According to the court's ruling in *Friends of Lake Turkana Trust vs. Attorney General and 2 Others*, the State is required under Article 69 to safeguard the environment, secure its preservation, and ensure the sustainability of the environment. This lawsuit also brought to light certain crucial environmental ideas, such as the precautionary principle and the notion of sustainable development.<sup>461</sup> The ELC is empowered under the Constitution upon application on infringement of the entitlement to a safe and clean environment, to give remedies like environmental restoration orders, compensation of the injured victim in the society and to make orders to discontinue activities that cause natural destabilization.<sup>462</sup> In *KM & 9 others vs The Attorney General & 7 others*<sup>463</sup>, the above mentioned remedies were all granted by the court. Among this case, the eighth respondent leased a nearby property to the seventh respondent, who

<sup>455</sup>Ibid, Sections 22, 23

<sup>456</sup>The UN commission on Environment and development report (Our common future) 1987

<sup>457</sup> Petrik, L., Green, L., Abegunde, A. P., Zackon, M., Sanusi, C. Y., & Barnes, J. (2017). Desalination and seawater quality at Green Point, Cape Town: A study on the effects of marine sewage outfalls. *South African Journal of Science*, 113(11-12), 1-10.

<sup>458</sup>Dyble Jonathan. n.d. *Limpopo Eco-industrial Park*. Africa Outlook.

<sup>459</sup>Constitution of Kenya 2010. Article 162(2)(b)

<sup>460</sup>Ibid. Article 70(1)

<sup>461</sup> Friends of Lake Turkana Trust vs the Attorney General and 2 others (2014)eKLR (Nairobi ELC)

<sup>462</sup> Constitution of Kenya 2010. Article 70(1)

<sup>463</sup>KM & 9 others v Attorney General & 7 others [2020] eKLR< <http://www.kenyalaw.org>.> 8 March 2022.

built a factory for recycling lead-acid batteries. The facility created hazardous sludge that seeped into the village and directly contributed to more than 20 fatalities and a variety of illnesses in the petitioners.<sup>464</sup>

The plaintiff was awarded Kshs. 500,000 in civil penalties for annoyance. The court also granted an injunction instructing the defendant to reroute all rain from the defendant's property away from the plaintiff's property using drainage with impenetrable lining.<sup>465</sup>

The National Environmental Tribunal (NET) is another institution used in implementation of the principles on environmental governance. It is initiated under section 125 of the EMCA. The bench book on environment and property matters specifically states that the NET's power is solely an adjudicative jurisdiction that is limited to resolving complaints regarding the granting or denial of a license, the inevitability of conditions, limitations, or restrictions on the license of the aggrieved party, the revocation, suspension, or modification of the aggrieved party's license, and an appeal regarding the amount that the aggrieved party is to pay as penalties by NEMA under the Act as per section 129(1) of EMCA.<sup>466</sup>

The National Government through institutions such as NEMA and WRA, are clothed with the mandate of ensuring EIA, EA, SEA and continuous monitoring have been undertaken as already noted above. These institutions, as stated earlier on also issue licenses and permits for effluent discharge into water resources by an entity. These matters will be addressed below.

### ***The Strategic Environmental Assessment (SEA)***

SEA is provided for under section 57(A) of EMCA.<sup>467</sup> The term "SEA" describes a variety of quantitative and interactive methods intended to incorporate environmental concerns into strategies, plans, and programs and assess how they interact with other factors.<sup>468</sup> The SEA procedure is meant to educate the society about any risks that the desired action or program may have to the public and environmental health.<sup>469</sup> The process entails preliminary identification and consideration of the possible negative impacts with the view of minimizing the potential

<sup>464</sup> Ibid page 1

<sup>465</sup> KM & 9 others v Attorney General & 7 others [2020] eKLR p. 31/33

<sup>466</sup> The Bench Book on Environment and Land Matters, The judiciary, Nairobi-Kenya (2019) 54-55

<sup>467</sup> See also The Environmental (Impact Assessment and Audit) Regulations, 2003, Regulation 42.

<sup>468</sup> National guidelines for SEA in Kenya page 1

<sup>469</sup> Tibilis, The Georgian Perspective; 'A Guide to Strategic Environmental Assessment' (2006) p 6;

damaging effects while increasing the effective effects of the programme.<sup>470</sup> Therefore, it considers the most eco-friendly alternatives and addresses them at the outset of a project of decision-making while outlining the brief, protracted, irreversible, and temporary implications of the proposed program.<sup>471</sup> Therefore, as per Legal Notice 101 of June 2003,<sup>472</sup> before an industry is constructed there must be a report on the SEA which should contain the pre-existing and emerging environmental concerns.<sup>473</sup> Public consultations should also be conducted as required by EMCA,<sup>474</sup> in order to comprehend the various aspects of the neighborhood and other important concerns that should be addressed in the SEA report.<sup>475</sup> Such issues may include the fear of environmental degradation by any aggravated air, soil or water pollution and disposal of untreated sewage.<sup>476</sup> In the *Mohammed Ali Baadi and others v Attorney General & 11 others*<sup>477</sup> the court determined that the public was not given adequate information regarding the LAPSSET project, and that there was also insufficient reasonable public engagement. Further the SEA report did not factor in other important factors such as the above noted, making it unprocedural. It was the court's finding that whereas SEA was supposed to be done before the continuation of the LAPSSET project, the same was not done. The court stated;

"That description (as per the laws) makes it apparent that the proposal will go much beyond what is thought to be "typical" environmental impacts of a project in planning and carrying out SEA. Instead, it is expected that the person proposing the project will evaluate, take into account, and advise on the "actual" costs associated with a strategy, or initiative. These costs include an introspection of the severity of health effects, and loss of welfare; a decrease in life expectancy associated with high disease spread brought on by air and water pollution; and other costs that cannot be quantified in terms of money; a decline in life quality linked to the same poisons, and so forth... Both the ESIA and the SEA were technically invalid due to the failure to take into account all of these issues."

The court instructed NEMA to make certain the SEA report sufficiently takes into account all the instructions established in rethinking the EIA permit when evaluating each

<sup>470</sup> Ibid page 11

<sup>471</sup> Ibid

<sup>472</sup>The Environmental (Impact Assessment and Audit) Regulations, 2003, Regulation 42.

<sup>473</sup> EPZA; Scoping Report in the SEA for the Leather Industrial Park (November 2015) p.32

<sup>474</sup>EMCA. Sec3

<sup>475</sup>Ibid (n 524) p.3

<sup>476</sup> Ibid

<sup>477</sup> (2018) eKLR; Petition 22 of 2012

element of the LAPSET Project and any supporting equipment because this was an ongoing project of national importance.

### **EIA, EA and Monitoring**

The EIA<sup>478</sup> and the EA<sup>479</sup> and Monitoring, find their basis from the Constitution; where they are stated as among the systems that the State is under obligation to establish for proper environmental monitoring.<sup>480</sup> The EIA, EA and Monitoring are among the mechanisms established under EMCA for environmental protection under parts VI and VII respectively.<sup>481</sup> NEMA is under obligation to identify the projects which require Environmental Audits or Monitoring to be conducted.<sup>482</sup>

Part VI of EMCA forms the substantive framework for EIA while the projects that must undergo the EIA are stipulated in the EIA regulations.<sup>483</sup> Project proponents must carry out the EIA and write a report<sup>484</sup> which will be published by them<sup>485</sup> and be handed over to NEMA for acceptance and granting of the EIA license.<sup>486</sup> It should be emphasized that until an EIA has been completed and certified by NEMA, a project proponent may not execute any project that may affect the environment.<sup>487</sup> In *Cortec Mining Kenya Ltd vs Cabinet Secretary Ministry of Mining & 9 others*,<sup>488</sup> the court upheld the rule that project sponsors shouldn't conduct plans that may adversely affect resources or for which an EIA is necessary under the EMCA.<sup>489</sup> The court also stated that there should be no licensing by any authority under law for a project unless the EIA report has been approved and a licence issued to the project proponent.<sup>490</sup>

The summary above shows how the EIA is an important and a mandatory requirement, and it is not in Kenya alone but even at the international level pursuant to principle

<sup>478</sup> Ibid

<sup>479</sup> EA tests the compliance level with the relevant laws and regulations as indicated earlier in the EIA study report

<sup>480</sup> Constitution. Article 69(1)(f)

<sup>481</sup> EMCA,

<sup>482</sup> Ibid. Sec 9

<sup>483</sup> (2003) Regulation four

<sup>484</sup> EMCA. Sec 58

<sup>485</sup> Ibid section 59

<sup>486</sup> Ibid section 58

<sup>487</sup> The Environmental (Impact Assessment and Audit) Regulations 2003

<sup>488</sup> (2015) eKLR

<sup>489</sup> Cortec Mining Kenya Ltd vs Cabinet Secretary Ministry of Mining & 9 others (2015) eKLR

<sup>490</sup> Ibid

17 of the Rio Declaration.<sup>491</sup> In *Sierra Club vs Coelman*,<sup>492</sup> the EIA is described as a tool that aids in the foreseeing and minimizing of the negative effects of development. It begins with the recognition of the need to provide a detailed discussion that would sufficiently allow the decision maker to fully consider the possible environmental effects and the alternatives that can be pursued with regards to the project.<sup>493</sup>

It is vital to note that social engagement is mandatory in the EIA process,<sup>494</sup> and thus should be strictly followed.<sup>495</sup> This is because public participation is among the fundamental principles of environmental conservation<sup>496</sup> stipulated in the Constitution,<sup>497</sup> in the Rio Declaration<sup>498</sup> and in various cases where the courts are to be governed by the ideas of environmental safety and social engagement in environmental sustainability.<sup>499</sup> On public participation, courts have developed some criteria to be applied,<sup>500</sup> the subject matter, as well as the reputation of the public actor,<sup>501</sup> the quantity and quality of interactions as well as the methods employed to contact as many people as feasible.<sup>502</sup> Thus for instance, if the issue relates to a proposed legislation, then those affected by it must be allowed an opportunity to make presentations on it.

The EIA Regulations describe Environmental Audit (EA) as the systematic assessment of project processes and functions to determine how closely they adhere to the project's approved environmental management plan and good environmental management practices.<sup>503</sup> Environmental Audits must be authorized by a professional and permitted accountant except in cases where self-auditing is permitted.<sup>504</sup> This is because there should be an audit report that will

<sup>491</sup> Bench Book on Environment and Land Matters, Judiciary (2019) P.200-201

<sup>492</sup> (1975)

<sup>493</sup> Ibid.

<sup>494</sup> Regulations 17, 21 & 22 of the EIA Regulations 2003

<sup>495</sup> Kwanza estate Ltd vs Kenya Wildlife Services (2013) eKLR

<sup>496</sup> Bench Book on Environment and Land Matters, Judiciary (2019) P. 27

<sup>497</sup> Article 69(1)(d)

<sup>498</sup> Principle 10

<sup>499</sup> EMCA. Sec 3(5)(a) & Sec 18(a)(i) of the ELC Act

<sup>500</sup> The Bench Book on Environment and Land Matters, The judiciary, Nairobi-Kenya (2019)P.27

<sup>501</sup> Mui Coal Basin Local Community & 15 others vs Permanent Secretary Ministry of Energy & 17 others (2015) eKLR

<sup>502</sup> Ibid (n 506) p. 27

<sup>503</sup> (2003) Regulation 2

<sup>504</sup> Ibid Regulation 31(2)

show the prosperity of the project concerning its effects and various mechanisms.<sup>505</sup> It is crucial to say that an individual has the latitude to petition NEMA to cause Environmental Audits to be conducted on a project,<sup>506</sup> and this should be conducted on regular basis and the reports submitted to NEMA.<sup>507</sup> In the case of *Kibos Distillers Limited v. Benson Ambuti Adega & Co.*, as previously mentioned, the court ordered NECC and NEMA to conduct ongoing inspections of the three appellants' factories to ensure that environmental standards are being kept. By guaranteeing that ecological safeguarding and management procedures are followed, this case shows that NEMA has a continuing duty to monitor and review operations carried out agencies to ensure that they do not contribute to environmental deterioration.<sup>508</sup> These assessments are to be examined and refined by the relevant implementing agencies and organizations to guard against real and actual environmental pollution and degradation.<sup>509</sup>

It is good to note that the EIA and monitoring discussed above is also emphasized under the Water Act 2016, especially during the application for the permit for one to be allowed to discharge pollutants into water resources.<sup>510</sup> It is a requirement that the application be subjected to public consultation and to the EIA in accordance with the provisions under EMCA.<sup>511</sup> The WRA is also under an obligation to monitor compliance with the conditions of the permit.<sup>512</sup> All these efforts are geared towards the safety of the legal entitlement to safe environment.<sup>513</sup>

### ***Effluent discharge in water resources and the procedure for licensing***

Water resources are to be protected from effluent discharges from industries and other sources, this is because the Constitution entitles every individual to healthy and fresh water and in sufficient amounts.<sup>514</sup> The Water Act<sup>515</sup> is the principal legal instrument after the Constitution for the adjustment, control and growth of water resources.<sup>516</sup> Under the Water Act 2016, there is

<sup>505</sup> Ibid (n 506) p. 202

<sup>506</sup> EIA Regulations (2003) Regulation 39

<sup>507</sup> *Kibos Distillers Limited & 4 others...*2018

<sup>508</sup> EMCA. Sec 9

<sup>509</sup> United Nations Conference on Environment & Development Rio de Janeiro, Brazil, 3 to 14 June 1992. Agenda 21.

<sup>510</sup> Water Act 2016. Section 36(c)

<sup>511</sup> Ibid section 40

<sup>512</sup> Ibid section 13

<sup>513</sup> Constitution of Kenya 2010

<sup>514</sup> (2010) Article 43(1)(e)

<sup>515</sup> 2016

<sup>516</sup> Understanding the Kenyan Water Act 2016 pdf. Page 1-2

established WASREB<sup>517</sup> and WRA in sections 70(1) and 11 respectively to carry out functions regarding protection of the interest of water consumers among other functions.<sup>518</sup> Therefore every individual should abstain from activities that cause any form of water pollution whether immediate or subsequent.<sup>519</sup> If a project proponent wishes to discharge any effluent, then he or she must obtain the Effluent Discharge License (EDL) from NEMA.<sup>520</sup> The Water Quality regulations<sup>521</sup> require that activities carried out near water sources to have the EIA license and not to discharge any effluent into aquatic environment from industries or other activities without a valid Effluent Discharge License.<sup>522</sup> In **Republic v National Environment Management Authority (NEMA) & 2 others; Ex-Parte Misty Mountain Lodge Ltd & another**,<sup>523</sup> the judge recognized that obtaining the EDL was an operational condition in the granting of the EIA permit to the Applicant.<sup>524</sup>

EDL's granting is however not to serve as permission for one to cause natural destabilization. The owner of an industry discharging effluent must put in place the effluent discharge quality monitoring mechanism and submit a quarterly record to NEMA.<sup>525</sup> This is to make sure that the pollutants discharged abide alongside the standards compiled in the 3<sup>rd</sup> schedule of the Water Quality Regulations 2006.<sup>526</sup> If the project proponent aborts to abide with the standards or state described in the license, then NEMA has the option to choose to withdraw the license to protect the general population.<sup>527</sup> For example, NEMA revoked the EIA license for the Kenya Agricultural Company KiliAvo Fresh Ltd, to secure the wellbeing of wildlife whose lives were in danger because of the uncontrolled company activities.<sup>528</sup>

<sup>517</sup> Ibid

<sup>518</sup> Prof Albert Mumma, 'The legal and institutional framework of the Water Act 2016 Slide

5<file:///C:/Users/Kevin%20koree/Downloads/The%20Legal%20&%20Institutional%20Framework%20of%20the%20Water%20Act,%202016.pdf>accessed 21 March 2022

<sup>519</sup> Environmental Management and Co-ordination (Water Quality) Regulations, 2006. Section 4

<sup>520</sup>EMCA. Sec 75(1)

<sup>521</sup>EMC (Water Quality) Regulations, 2006

<sup>522</sup> Ibid section 6(a)&(b)

<sup>523</sup> (Judicial Review Miscellaneous 6 of 2019,) [2020] eKLR

<sup>524</sup> Ibid para. 36

<sup>525</sup>EMC (Water Quality) Regulations, 2006, section 14(1) & (2)

<sup>526</sup>Ibid, section 11

<sup>527</sup> EMCA, section 76

<sup>528</sup> See in; NEMA Revokes the Environmental Impact Assessment license for KiliAvo Farm,

The licensing procedure under EMCA,<sup>529</sup> is precisely summarized in the Waste Management Regulations 2006 Information Handbook.<sup>530</sup> The applicant is supposed to fill all the forms provided by NEMA, attach the design plan of the waste disposal facility, pay application fee or any other appropriate fee, the dully filled forms are then returned to the district environmental officer to forward them to NEMA headquarter for processing.<sup>531</sup>

NEMA is to review the application within 21 working days then give an approval with specific conditions or in case of a decline, then the reasons to be stated to the applicant, if the application is approved the applicant is to pay the required fee as per the activity as stated under schedule four of the Waste Regulation.<sup>532</sup> The issued wastewater discharge license is subject to yearly renewal with documentation of adherence to the license's specific criteria and waste disposal requirements under the local authority Act and Regulations<sup>533</sup> to certify that there is sustainable disposal of waste.<sup>534</sup>

The Water Act also provides for the need for a permit for one to be allowed to discharge pollutants into any water resources.<sup>535</sup> The permit is obtained by first applying to the authority and the application should be accompanied by all the necessary information and the fees required, for it to be determined by WRA within the six months as per section 40. The application should be subjected to public consultation and to the EIA as required by EMCA and then a notice of the same is to be published to invite objections on the application. This should last for 30 days. In case of an objection, the objector is to communicate in writing then the WRA will communicate to the applicant and the objector within 30 days as stipulated under section 40 of the Act. If WRA denies the petition, it must offer an explanation for its decision, and if it takes longer than six months to decide, the applicant has the right to the refund of any costs paid.<sup>536</sup>

The Water Resource Regulations of 2021 also provide rules for the control of wastewater release into water resources. They provide that a person shall not discharge effluent or any pollutants

<sup>529</sup>EMCA, section 88

<sup>530</sup> NEMA. Enhancing waste management in Kenya. 2014, pages 23-24

<sup>531</sup> Ibid page 23

<sup>532</sup>(2006)

<sup>533</sup> (2012)

<sup>534</sup> NEMA, 'Enhancing waste management in Kenya,' (2014) P.24

<sup>535</sup> Water Act 2016 section 36(c)

<sup>536</sup> Water Act 2016, section 40



into water resources unless the effluent or pollutant is authorized by WRA and is treated to the permissible standards.<sup>537</sup> This means that the person must apply for an effluent or waste disposal permit from WRA before discharging effluent or waste into water resources.<sup>538</sup> This begins by the person applying for the permit from WRA as for water use activity,<sup>539</sup> before commencing the activity itself.<sup>540</sup> Again WRA will allow for a time period of 30 days to invite objections just as stated above in the Water Act, before any decision regarding the application is made.<sup>541</sup> If objections to the application are received then the WRA will communicate through a notice within less than 14 days to the objectors and the applicant, for a meeting to be held in public to determine the objections.<sup>542</sup> In case the application is rejected, WRA will within 30 days communicate to the applicant in writing as per rule 22 and if the applicant is aggrieved, he/she can appeal to the Water Tribunal.<sup>543</sup> On the other hand if the application is allowed, the applicant will be authorized to carry on with the activity,<sup>544</sup> and WRA may upon inspection issue the waste or effluent discharge permit.<sup>545</sup>

The permit being discussed above also covers the effluent discharge permit which once issued, the holder of the permit is bound to discharge such effluent in accordance with the conditions specified under the permit.<sup>546</sup> The permit holder is to also maintain the effluent discharge records to show the quality and quantity of the effluent being discharged and to submit those records to WRA.<sup>547</sup> The permit holder is also under obligation to renew the permit three months prior to the expiry date,<sup>548</sup> and to have in mind that the permit issued is subject to conditions and it can be canceled or be varied by WRA on its own motion and upon giving a notice of 30 days.<sup>549</sup> Again this goes back to the earlier stated fact that the permit is not absolute and it can be canceled if the conditions under it are not adhered to or for the interest of the environment.

<sup>537</sup> Water Resource Regulations 2021. Regulation 61(1)

<sup>538</sup> Ibid Regulation 61(2)

<sup>539</sup> Ibid Regulation 5

<sup>540</sup> Ibid Regulation 7

<sup>541</sup> Ibid Regulation 19

<sup>542</sup> Ibid Regulation 21

<sup>543</sup> Ibid Regulation 22

<sup>544</sup> Ibid

<sup>545</sup> Water Resource Regulations 2021. Rule 64

<sup>546</sup> Water Resource Regulations 2021. Regulation 61(5)

<sup>547</sup> Ibid Regulation 64

<sup>548</sup> Ibid Regulation 36

<sup>549</sup> Ibid Regulation 35

### ***County government functions***

The fourth schedule of the Constitution requires the city councils to carry out certain national government initiatives on natural resources and environmental preservation, with one of the primary responsibilities being water conservation.<sup>550</sup> Additionally, the County Governments have the authority to oversee the correct management of storm water systems in populated areas.<sup>551</sup> They also have an obligation to ensure participation of the local communities<sup>552</sup> which entail inclusion of the local communities on matters of environment as described in chapter 23 of the Agenda 21.<sup>553</sup>

EMCA vests in the counties through the County Environmental Committee, the duty to ensure proper environmental management and development of 5 year environmental strategic plan for the counties.<sup>554</sup> Here, the requirement for active involvement of the local communities in waste management, creating awareness on recycling as among the mechanisms for waste management, to achieve collective wisdom in implementation of waste management policies by them becoming agents of change and promoting economic competitiveness and efficiency.<sup>555</sup>

### ***The right to a safe and healthy environment***

The Constitution provides a broad aspect of environmental protection, sustainability and conservation.<sup>556</sup> This element envisions the enforcement of a collection of human rights resulting from activity, i.e., the environmental human rights approach takes into account how the environment affects human life, health, privacy, and property.<sup>557</sup> The court determined in *Adrian Kamotho Njenga v. Council of Governors & 3 others* that Article 42 assures everyone the privilege to a clean surrounding outlined in Article 69.<sup>558</sup> Environmental rights are acknowledged in *The Social and Economic Rights Action Centre and the Centre for Economic and Social Rights v. Nigeria* because they are intimately related to socio - economic rights in as much as the environment impacts people's health and safety. The statement or decision intends to

<sup>550</sup> Constitution of Kenya 2010, Fourth Schedule, part 2, function 10

<sup>551</sup> Ibid function 11

<sup>552</sup> Ibid function 14

<sup>553</sup> United Nations Conference on Environment and Development...

<sup>554</sup> EMCA, Sec 30

<sup>555</sup> Ministry of environment and forestry, 'National Sustainable Management Policy (Discussion draft) p.10.

<sup>556</sup> Constitution of Kenya 2010, Article 42

<sup>557</sup> Kariuki Muigua, 'Nurturing our Environment for Sustainable Development. Glenwood Publishers (2016) p. 46-47

<sup>558</sup> [2020] eKLR, Environment and Land Petition 37 of 2017.

assist States in implementing their environmental and human rights commitments and obligations more quickly.<sup>559</sup>

This is accordant with internationally recognized essence of environmental law, particularly sustainable development and intergenerational equity;<sup>560</sup> which seek to guarantee that the environment is safe, managed and preserved.

Arising from the Constitution are various legislations relating to the environment which mostly give effect to the provisions of Articles 42, 69 and 70. This entitlement covers the right of access to various activities and divisions for various activities like, access to health, education, recreational and cultural usages of the environment.<sup>561</sup>

This court is authorized to grant remedies for the various violations of the right which include but not limited to; restoration orders, orders for compensation, orders for the discontinuation of the activities causing the violation of the right, and orders for the prevention of the acts or omissions.<sup>562</sup> The works of the ELC have been seen in the recent past in the ruling of *KM & 9 others v Attorney General & 7 others*,<sup>563</sup> where the court held that the State is responsible for the safety of the privilege to a relatable surrounding and to compensate those ones affected by its act or omissions leading to the infringement. Also, in New South Wales in the case of *Brunsdon v The Council of the City of Wagga Wagga*,<sup>564</sup> where the applicant was denied approval for a piggery facility on grounds that the impact of the facility would be deleterious to ground water and watercourse contamination coupled with the foul odor. The development was thus denied under the Environmental Planning and Assessment Act which provided for the implementation of the precautionary principle,<sup>565</sup> a decision which coincides with the orders.<sup>566</sup>

As stated in *The Social and Economic Rights Action Centre and the Centre for Economic and Social Rights vs. Nigeria* case, the entitlement to a relatable surrounding also incorporates human rights like those relating to quality standards of well-being, sanitation and access to safe and

<sup>559</sup> Ibid

<sup>560</sup> Otto Spijkers, 'Intergenerational Equity and the Sustainable Development Goals' (2018) p.10 Sustainability 3836.

<sup>561</sup> Ibid, Section 3(2)

<sup>562</sup> EMCA. Sec 3(3)

<sup>563</sup> Petition 1 (2016) eKLR

<sup>564</sup>(2003) NSWLEC 168

<sup>565</sup> Bench Book on Environment and Land Matters, the Judiciary (2019 Nairobi-Kenya) p. 214

<sup>566</sup> Constitution of Kenya 2010. Article 70(2)(b)

clean water under Article 43.<sup>567</sup> Other rights connected to the entitlement to a relatable surrounding include; the entitlement to life,<sup>568</sup> the entitlement to human dignity,<sup>569</sup> the political and economic rights,<sup>570</sup> and entitlement to knowledge.<sup>571</sup> Civil rights and environmental conservation are related because both work to protect humankind's health.<sup>572</sup>

Another illustration is that the entitlement to access information is violated when there is no or insufficient public input during the awarding of EIA permits, in the sense that the EIA license can be revoked on the basis of want of meaningful public participation. This is because the EIA provides all the information concerning the project including the potential negative effects and the mitigation circumstance. In the case of *Abdallah, Chairman, Donholm phase 5 Residents' Association v. Director General NEMA*, the tribunal determined that the project's proponent had improperly conducted stakeholder engagement, denying the stakeholders' right to public participation.<sup>573</sup>

An infringement of ones' entitlement to a safe and clean environment also may usher to a direct infringement of the entitlement to life and the entitlement to human decency. An example being the case of *KM & 9 others v Attorney General & 7 others*<sup>574</sup> where the pollution from the lead factory led to the subsequent loss of life.<sup>575</sup> This shows that human rights depend on livable planet<sup>576</sup> and that is why man places himself at the center of apprehension for viable growth.<sup>577</sup>

Therefore, it is important to handle environmental regulation as a human rights problem since it will specifically address how the environment affects human life, health, and personal and property rights.<sup>578</sup>

<sup>567</sup> Ibid (n 597) p.31

<sup>568</sup> The Constitution, Article 26. See also the Peter K. Waweru HC Misc. Civil Application No. 118 of 2004, case.

<sup>569</sup> Ibid, Art 28

<sup>570</sup> Ibid, Art 43

<sup>571</sup> Ibid, Art 35

<sup>572</sup> Kariuki Muigua, 'Fostering Environmental Democracy and Biodiversity Conservation' (Glenwood Publishers Ltd, 2021) P.11

<sup>573</sup> Tribunal appeal no NET/38/2009 see paragraph 31 and 32.

<sup>574</sup> Petition 1 of 2016 eKLR

<sup>575</sup> Constitution of Kenya Article 43(1)(a)

<sup>576</sup> Kariuki Muigua, 'Nurturing Our Environment for Sustainable Development (Glenwood Publishers, 2016) p.47

<sup>577</sup> The Rio Declaration, (1992) Principle 1

<sup>578</sup> Ibid (n 608) pp 46&47

### ***Penalties for polluting the water resources***

Both environmental and ethical security are threatened by water contamination. Every individual has an explicit right to access to sufficient supplies of fresh, clean drinking under the Constitution.<sup>579</sup> The Water Act further emphasizes on the entitlement to clean water of the right quantities,<sup>580</sup> as envisaged under Article 43. In *Isaac Kipyego Cherop v State Ministry of Water & 142 others*,<sup>581</sup> the court accepted that the right to fresh water and to a clean environment are related. There is therefore need to safeguard this right as in the Constitution, EMCA, Water Act, Water Resources Regulations, 2021 and under the EMCA (Water Quality) Regulations 2006. There are various penalties ranging from fines, imprisonment to closing and demolition of industries discharging raw effluent into water sources without a valid EDL.

EMCA creates offenses relating to pollution under Section 142 where it provides that anyone who releases any contaminant to the surroundings under the Act is liable to an offence which attracts fines of a million or more Kenyan shillings, or a two year jail sentence or both.<sup>582</sup> The Act essentially makes the disposal of any pollutant into the environment whether air, water or land, an offence of which the Act itself provides for the penalties for such default.<sup>583</sup> An example is in the case of *Owino-Uhuru*,<sup>584</sup> where air pollution caused by Sulphur Dioxide and Carbon Monoxide led to the formation of acidic rain which steers to pollution of water. The court found against the defendants for offenses such as those mentioned under section 142 of EMCA and subsequently awarded the plaintiffs damages for the losses occasioned.

The Water Act<sup>585</sup> provides for the offence of any obstruction or pollution of water resources where a person who is not authorized to obstruct,<sup>586</sup> throw or permit to be thrown anything into a water resource that is likely to cause pollution, commits an offence under the Act.<sup>587</sup> Those found liable for the offence created under the Act, the Water Services Regulatory Body or the body concerned with licensing may order for the cleanup or removal of the thing that has been

<sup>579</sup> Constitution of Kenya 2010. Article 43 (1)(d)

<sup>580</sup> Water Act No 43 of 2016. Section 63

<sup>581</sup> (2017) eKLR

<sup>582</sup> EMCA. Sec 142(1)

<sup>583</sup> Ibid Sections 142(2) & (3) and 143

<sup>584</sup> *KM & 9 others v Attorney General & 7 others* Petition 1 of 2016 eKLR

<sup>585</sup> Water Act 2016. The preamble.

<sup>586</sup> Ibid. Sec 143(1)(a)

<sup>587</sup> Ibid, Sec 143 (1)(b)

employed in the pollution.<sup>588</sup> If the polluter fails to comply with the orders envisaged under Section 144(1), then the body involved should take any step necessary to stop the pollution incurring the costs thereto; in doing so, the body can thereafter claim from the polluter the sum incurred.<sup>589</sup> The Act further provides that where there is no penalty prescribed under the Act, then the offender is responsible for a penalty not more than one million shillings or prison sentence not more than two years.<sup>590</sup>

Effluent discharge into water bodies is in many ways intertwined with health such that one cannot deal with one at the exclusion of the other. Public health is always at risk whenever water resources are polluted. As such the Public Health Act<sup>591</sup> has in it provisions for nuisance with regard to pollution of water from any noxious waste released from any property into the surroundings or watercourse where the reception has not been approved is said to constitute nuisance.<sup>592</sup> If any such nuisance as contemplated by Section 118 occurs, then a medical officer is entitled to give a notice to the party causing the nuisance to remove the nuisance.<sup>593</sup> Where the notice of removal is not complied with, then that person is guilty and answerable to a penalty of not more than one thousand five hundred shillings for everyday the non-compliance proceeds.<sup>594</sup> The Public Health Act though an old piece of legislation, speaks to contents of Articles 42 and 43(a)-(e). It seeks to redress malpractices in waste disposal that contravenes the entitlement to the elevated achievable standards of well-being and to fresh water that is in sufficient quantities.<sup>595</sup> Nevertheless, it needs to be revised in order to modify the fines imposed under it so that they are consistent with the Constitution's spirit with regard to environmental preservation. Similarly, the review would be in tandem with EMCA and WRA so as to deter non-compliance.

In the case of *Peter K Waweru*,<sup>596</sup> the court in quashing the case due to technical and constitutional issues, the court gave out mandating orders to the Ministry of Water constituting the Nairobi West Water Services Board and the Olkejuado County Council. They were to ensure

<sup>588</sup> Ibid, Sec 144 (1)

<sup>589</sup> Ibid, Sec 144(2)

<sup>590</sup> Ibid, Sec 147

<sup>591</sup> CaP 242 of the Laws of Kenya

<sup>592</sup> Ibid Sect 118(1)(e)

<sup>593</sup> Public Health Act CaP 242. Section 119

<sup>594</sup> Section 121

<sup>595</sup> Constitution of Kenya 2010. Article 43(1)(d)

<sup>596</sup> Peter K. Waweru v Republic (2006) eKLR

there is installation of sewerage treatment works for treatment of the sewage water that had been complained of being dumped raw into Kiserian River.<sup>597</sup> This case takes us back to the remedies the court can issue in seeking to redress the pollution caused, which is giving restoration orders and compensation of the victim injured by the pollution.<sup>598</sup> These coincide with the contaminator pays principle under EMCA<sup>599</sup> and on the ruling of *Mohamed Ali Baadi vs the A.G and 11 others*.<sup>600</sup>

NEMA has also been arresting industries' managers and closing industries as one way of ensuring compliance with the EDLs requirements.<sup>601</sup> Another example was in the news posted on the NEMA website which showed the industries that had been contravening the Water Quality Regulations 2006, by releasing wastewater into the sewers without pretreatment systems in Nairobi county.<sup>602</sup> 25 out of the 78 identified were demolished while some of the factories were closed and the owners arrested and prosecuted in court of law.<sup>603</sup> Those closed include but not limited to Synresins, Apex Coating East Africa, Thorlite Kenya, and Sameer Agriculture and Livestock Limited (Daima).<sup>604</sup>

It should be noted that the penalties addressed above are all geared towards safeguarding water resources which form part and parcel of the environment.

### ***Safeguards: Monitoring and compliance***

The Constitution does this through various institutions like NEMA and courts and through processes like the EIA, EA and Environmental monitoring. The Constitution has explicit provisions on the powers of court to receive complaints on infringement of the said rights as among the methods of ensuring compliance .<sup>605</sup> Upon receiving the same, the court must determine its decision in accordance with the EMCA's intergenerational equity, preemptive, polluter pays, and social involvement principles.<sup>606</sup> These principles were also addressed in

<sup>597</sup> Ibid

<sup>598</sup> Constitution of Kenya 2010. Article 70(2)

<sup>599</sup> Environment Management and Co-ordination Act no.8 Of 1999. Section3(5)

<sup>600</sup> Mohamed Ali Baadi and others v Attorney General & 11 others <<http://www.kenyalaw.org.> >accessed 8 March 2022.

<sup>601</sup> Citizen TV News. (2019). NEMA closes down 5 factories for discharging effluent into Nairobi River.

<sup>602</sup> NEMA, Factories closed, owners arrested for polluting

<sup>603</sup> Ibid.

<sup>604</sup> Ibid.

<sup>605</sup> Article 70

<sup>606</sup> EMCA. Sec 3(5)

**Kwanza Estates Ltd v Kenya Wildlife Services**<sup>607</sup> where it was emphasized on the need for public involvement.

The remedies the court can give can be an order for compensation to be paid to the injured person,<sup>608</sup> as it was in the case of Mohamed Ali Baadi<sup>609</sup> where the project promoter offered to grant Kshs. 1,760,424 in remuneration to those who were impacted.

The court can also issue orders to stop the activity causing pollution,<sup>610</sup> as it was in the previously stated case of **KM and 9 others**.<sup>611</sup> The high court issued a compulsory injunction requiring the defendant to use drainage to divert all rain water that starts on the defendant's property. The main goal was to prevent the leakage of toxic waste to the complainant's premises, which brings into picture the requirement of the Common Future report<sup>612</sup> on sustainable economic development.

NEMA is among the institutions or regulatory bodies used to ensure compliance. It is empowered under EMCA to bring about programme(s) that promote environmental education, public awareness and public participation,<sup>613</sup> which is a mandatory obligation of state agencies.<sup>614</sup> NEMA also identifies the projects and programme(s) on which Environmental Audits ought to be done, and makes sure that assessment and monitoring is carried out and reports presented before it for monitoring future compliance.<sup>615</sup> NEMA also conducts research, investigations and surveys concerning the environment<sup>616</sup> to prevent natural destabilization. For instance, the inspection conducted by NEMA on the Export Processing Zone Authority (EPZA) which showed that most industries never complied with the Water Quality Regulations 2006, by releasing poisonous waste into River Athi.<sup>617</sup> Another example is referred from 25<sup>th</sup> October, 2021 when NEMA officers toured some parts of Athi River in Mavoko sub-county alongside the

<sup>607</sup> Civil Case No.133 of 2012

<sup>608</sup> Constitution of Kenya 2010. Article 70(2) ( c)

<sup>609</sup> < <http://www.kenyalaw.org>. > 8 March 2022.

<sup>610</sup> Constitution of Kenya 2010. Article 70(2) (a&b)

<sup>611</sup> KM & 9 others vs The AG & 7 others (2020) eKLR

<sup>612</sup> The United Nations Commission on Environment and development (Our Common Future) Report 1987

<sup>613</sup> EMCA. Sec 9

<sup>614</sup> British American Tobacco Ltd vs Cabinet Secretary for the Ministry of Health & 5 others (2017)

<sup>615</sup> Kibos Distillers Limited & 4 others v Benson Ambuti Atega & 3 others (2018)

<sup>616</sup> EMCA. Sec 9

<sup>617</sup> NEMA, Factories closed, owners arrested for polluting.



residents of Kinanie.<sup>618</sup> This was after the residents complained over an increased pollution rate resulting from the discharge of effluents by the factories in the area.<sup>619</sup> The touring officers were surprised to find that the River Athi water had turned pink.<sup>620</sup> As a result, NEMA gave a strict caution to the industries in Mavoko that discharged effluents to River Athi, then samples of water was taken to the government laboratory for assessment on the level and kind of pollution.<sup>621</sup> .

NEMA also makes sure that every project is in line with the strategies of future growth and the responsibility to safeguard the eco-system.<sup>622</sup> That is, the project activities correspond to the environmental conservation and resources dimension, which is done by calling for EIA to be done before the project commences and a license to be granted in response. <sup>623</sup> In **Kwanza Estates Ltd v Kenya Wildlife Services**<sup>624</sup> the defendant failed to acquire an EIA report before construction. The court determined that the EIA was a crucial tool for letting the owner of a proposed project know the impact the activity or project would likely have on the surroundings and allowing decision-makers to come up with mitigation strategies that would lessen or eliminate any damage. EIA was also viewed as the essential procedure that ensures compliance and creation of mitigation measures where there are possibilities of the project to cause pollution, and also that the EIA report must be published.

The same is also provided for under the Water Act, where it is required that the application for one to discharge pollutants into water resources must be subjected to public consultation and to the EIA as required by EMCA.<sup>625</sup>

### **3.3 Commentary on the Sustainable Waste Management Act, No. 31 of 2022**

On July 6, 2022, the Sustainable Waste Management Act was signed into law by the president. It went into effect to guarantee the country's legislation and execution of solid waste

<sup>618</sup> The Standard. 2021. NEMA issues stern warning to factories discharging waste into Athi River 2

<sup>619</sup> Ibid.

<sup>620</sup> Ibid

<sup>621</sup> Ibid

<sup>622</sup> The Rio Declaration of 1992

<sup>623</sup> The four main dimensions of Agenda 21, the second section

<sup>624</sup> Civil Case No.133 of 2012

<sup>625</sup> Water Act 2016. Section 40

management.<sup>626</sup> In **Isaac Kipyego Cherop v State Ministry of Water & 142 others**,<sup>627</sup> it was determined that accessing fresh water is linked to the right to a clean environment, both of which should be upheld in conformity with the Constitution's provisions,<sup>628</sup> EMCA,<sup>629</sup> and the Water Act of 2016.<sup>630</sup> From the foregoing, the Act was enacted as a support legislation in the implementation of the various articles and sections from the aforementioned legislations. This is the latest piece of legislation that is geared towards the realization of a green and clean environment.<sup>631</sup> It addresses all types of garbage generally, and for the sake of this research, the term "waste" includes industrial waste.<sup>632</sup>

The goals of the Act as outlined under Section 3,<sup>633</sup> show that the Act is in all ways geared towards ensuring that the waste management system is sustainable for the promotion of the entitlement to a safe and clean environment as provided by the law,<sup>634</sup> which is generally intertwined with other constitutional rights under the Bill of Rights.<sup>635</sup> Sustainable garbage control is deemed at improving the general well-being of all citizens through reduced air, land, fresh water and marine pollution; creating an enabling environment in waste management, recycling and recovery. Additionally, a system and infrastructure for waste minimization must be established.<sup>636</sup> The Act's goals are consistent with those of NEMA, the authority that oversees its administration.<sup>637</sup>

The Local Governments have been referred to numerous times throughout the Act because they are crucial to the legislation governing sustainable waste management. The regions must engage with the public and the relevant national government agencies,<sup>638</sup> use the available land within the counties for waste management. By investing in garbage collection, classification,

<sup>626</sup> Constitution, Article 42.

<sup>627</sup> (2017) eKLR

<sup>628</sup> *ibid*

<sup>629</sup> EMCA. Sec3

<sup>630</sup> Water Act No 43 of 2016. Section 63

<sup>631</sup> Kenya: New Law on Sustainable Waste Management Enacted.

<sup>632</sup> SWMA no.31 of 2022. Section 2.

<sup>633</sup> *Ibid*, Section 3

<sup>634</sup> Constitution of Kenya 2010. Article 42

<sup>635</sup> Constitution of Kenya 2010. Chapter 4 on Bill of Rights

<sup>636</sup> Sustainable Waste Management Act no. 31 of 2022. Section 3 (a)-(i)

<sup>637</sup> Sustainable Waste Management Act. Section 2

<sup>638</sup> *Ibid*, Sect 11(1)

purification, treatment, recuperation, and hygienic final disposal, they must practice sustainable waste management when using this property.<sup>639</sup> To cope with the last sorting, separation, and recycling of trash created or brought to the county waste facilities, each individual county must have constructed a materials recovery plant.<sup>640</sup> The County Governments are also to formulate legislation for sustainable waste management and to establish waste recovery and recycling facilities within the county.<sup>641</sup> The Local Governments are required to create and present integrated solid waste management plans to the appropriate county legislatures for authorization as part of the formation of the waste management legislation(s).<sup>642</sup>

The Act provides for waste segregation,<sup>643</sup> where it requires all entities producing waste whether public or private, to segregate non-hazardous wastes into organic and inorganic wastes and place them in separate containers that are well labeled.<sup>644</sup> Hazardous wastes should be handled in such a manner as prescribed by EMCA.<sup>645</sup> Anyone who generates waste is obligated to segregate the waste in agreement with the distribution of the Act, and to dispose the waste only to licensed waste service providers or to designated garbage collection points.<sup>646</sup> Anyone who fails to observe waste management practices under Section 20(1) commits an offence of which the liability is a penalty not more than twenty thousand shillings or a prison sentence of not more than six months or both.<sup>647</sup> The duty of handling segregated waste in accordance with the Act is on the waste service providers, who are then to deliver the segregated waste collected to the designated and licensed waste collection facilities or landfills.<sup>648</sup>

The effective waste management goal of the Act is greatly aided by the commercial sector. They must create a three-year waste management strategy and provide yearly accounts to the Authority detailing the amount of garbage being produced and the corporate entity's waste

<sup>639</sup> Ibid, Sect 11(2)

<sup>640</sup> Ibid, Sect 14

<sup>641</sup> Sect 17

<sup>642</sup> Sect 18

<sup>643</sup> Waste Segregation: All you need to know; The act of detecting, splitting, and sorting waste products in an effort to minimize, reuse, and recycle is known as waste segregation.

<sup>644</sup> Sustainable Waste Management Act. Section 12 (1) & (2)

<sup>645</sup> EMCA 1999, part VII, section 87

<sup>646</sup> Sustainable Waste Management Act. Section 20(1)

<sup>647</sup> Ibid, Sect 20(2)

<sup>648</sup> Ibid, Sect 21

management techniques.<sup>649</sup> This coincides with the requirement for regular Environmental Audits under EMCA.<sup>650</sup> The entity is to adopt a cleaner production principles including; limiting the use of toxic waste raw materials for production, a reduction of toxic wastes and emissions and an improvement of the production process.<sup>651</sup> These private entities that generate wastes should separate toxic substances and dispose the same in facilities provided by the Authority or the respective county governments.<sup>652</sup>

There is the establishment of the Waste Management Council in a year for the commencement of the Act.<sup>653</sup> The Council is to work under the Act to ensure there is an enhanced and inclusive inter-governmental coordination to ensure there is sustainable waste management. The government should also assess how well the nationwide sustainable waste management initiatives that have been put in place are being implemented. In that regard recommend to the Cabinet Secretary, the national waste management recovery and recycling targets, reviewing, mobilization of resources and synchronization of the development of waste management infrastructure. The council is to recommend to the Cabinet Secretary any incentives that will promote sustainable waste management.<sup>654</sup>

NEMA is the main body tasked with environmental protection and conservation through the various functions under EMCA.<sup>655</sup> Under this Act, NEMA is tasked with monitoring and evaluation of waste management activities of private entities and County Governments.<sup>656</sup> This will be done by making guidelines that detail the process that private organizations must follow when reporting on their compliance with the established regulations.<sup>657</sup> The authority has the power to conduct investigations into both individuals and organizations to ensure that the Act is being followed.<sup>658</sup> The monitoring of compliance gives the Authority all the power needed to investigate adherence to the Act which includes the ability to set foot into the property of any

<sup>649</sup> Sustainable Waste Management Act. Section 19(1)

<sup>650</sup> Part VII sections 68 and 69

<sup>651</sup> Sustainable Waste Management Act. Section 19(4)(a)

<sup>652</sup> Ibid, Section 19(5)

<sup>653</sup> Ibid, Section 6(1)

<sup>654</sup> Ibid, Section 7(1) (a)- (h)

<sup>655</sup> EMCA. Sec 9

<sup>656</sup> Sustainable Waste Management Act. Section 26(1)

<sup>657</sup> Ibid, Sect 26(2) & (3)

<sup>658</sup> Ibid, Sect 27(1)

private organization.<sup>659</sup> Any act of hindering the performance of the Authority of its functions, or failure to disclose information that is lawfully required or who gives false information to the Authority,<sup>660</sup> and is found guilty of any such offence shall be responsible to a penalty as stated earlier in this paper.<sup>661</sup>

In conclusion, from the outlined provisions of the Act, it is safe to say that its implementation will be a bold step in ensuring there is efficient and sustainable management of –industrial-wastes. This however wholly rests on how effective the implementation will be. The tasks allocated to the Waste Management Council and NEMA under the Act should be keenly examined and implemented to ensure there is organized coordination in the performance of their mandate as provided for in the Act, and to meet the objectives.<sup>662</sup>

### **3.4 Challenges within the regulatory framework**

Kenya has an explicit legal framework for industrial wastewater governance, however, this legal framework's adequacy and probably effectiveness is hampered by various challenges like complexity, duplicity of roles, and institutional failure, which are addressed below.

#### **3.4.1 Complexity of the legal framework for industrial wastewater management**

Industrial wastewater management is regulated by a variety of legislations and regulations with scattered provisions on wastewater management, which make the legal framework to look a bit complex. For example, the EMCA and the Water Act which govern effluent discharge under sections 74 to 77 and sections 36 and 108 respectively. This same subject was observed in a study by Florence Ogotu shows that the existing framework for waste management in Kenya is inadequate due to the fact that it is found in various legislations and by-laws. Add to that the newly enacted piece of legislation, the Sustainable Waste Management Act, which is yet to be fully operational on account of subsidiary legislations and other bodies yet to be enacted and formed, respectively.<sup>663</sup> On the same note, this has been the principal cause of poor coordination

<sup>659</sup> Ibid, Sect 27(2)

<sup>660</sup> Ibid, Sect 27(3)

<sup>661</sup> Ibid, Sect 27(4)

<sup>662</sup> Ibid, Sect 27(4)

<sup>663</sup> Ibid

of policies on waste management especially between the regulations and by-laws, which do not coincide with the actual practice on the ground as already shown by the various instances.<sup>664</sup>

An example is for instance the establishment of NEMA under EMCA<sup>665</sup> with its functions under sections 7 and 9 respectively, the same with other obligations is established under sections 26 and 27 of the Sustainable Waste Management Act.<sup>666</sup> This contributes to the complexity of the governmental structure for industrial wastewater governance in Kenya. Similarly, the Water Act, initiates WRA and WASREB which have overlapping mandate with respect to water management which includes factors such as the quality as affected by effluent.<sup>667</sup>

In essence we have several pieces of legislation affecting the same issue –effluent discharge in-water resources.

### 3.4.2 Institutional failure

Institutional failure negatively affects the enforcement of the law. Several studies on the East African cities found that the existing laws on waste management are not being effectively enforced.<sup>668</sup> Organizational collapse is typically caused by a lack of collaboration amongst organizations, especially those that operate within the framework of international law and at all levels of government.<sup>669</sup>

There have been claims and cases where NEMA fails on its mandate to protect the environment by unprocedural issuance of EIA license or by failing to consider the pertinent issues like that of meaningful public participation.<sup>670</sup> It should be noted that the EIA as held in *Kwanza's Estate case*<sup>671</sup> is an important tool for informing the probable effects an activity or enterprise can have

<sup>664</sup> Akinyi Florence Ogutu, 'Assessment of the effectiveness of the policy framework on solid waste management in Nairobi, Kenya' (2015) pp.73-74. 2

<sup>665</sup> EMCA, 1999

<sup>666</sup> (Part VII) No. 31 of 2022

<sup>667</sup> Water Act Act no.43. Sections 11 and 70 respectively.

<sup>668</sup> Akinyi Florence Ogutu, 'Assessment of the effectiveness...

<sup>669</sup> See

<[http://erepository.uonbi.ac.ke/bitstream/handle/11295/99388/Kariuki\\_Global%20Strategy%20Implementation%20Challenges%20of%20Kenya%E2%80%99s%20Multilateral%20Environmental%20Agreements%20With%20the%20United%20Nations%20Environment%20Programme%20in%20Nairobi%20](http://erepository.uonbi.ac.ke/bitstream/handle/11295/99388/Kariuki_Global%20Strategy%20Implementation%20Challenges%20of%20Kenya%E2%80%99s%20Multilateral%20Environmental%20Agreements%20With%20the%20United%20Nations%20Environment%20Programme%20in%20Nairobi%20)> accessed 11 October 2022

<sup>670</sup> Ex parte Sound Equipment Ltd. v. Republic A new EIA should be conducted by NEMA with a thorough evaluation of the possible effects related to the project and to establish forum for the public participation of stakeholders involved, according to one of the grounds for the appeal, which included a lack of relevant public participation. A situation where EIA licenses were awarded in accordance with procedure is the Owino-Uhuru one.

<sup>671</sup> Kwanza Estate Ltd vs Kenya Wildlife Services, Civil case no. 133 of 2012

on the surroundings. Decision-makers can then create mitigation strategies to lessen or completely prevent any harm as a result, thus NEMA should ensure that the procedure for the same is duly followed. An example of such unprocedural EIA license issuance like the one mentioned above concerning inadequate meaningful public participation is in the case of *Amu Power Company Ltd.*<sup>672</sup> In this matter, the first respondent was a society-based organization that supported Lamu's welfare and interests, and whose membership included both people and a number of local civic organizations. In order to challenge the issuing of the EIA License as well as the procedure for acquiring it, they filed a lawsuit on November 7, 2016.

The EIA was founded on a variety of issues, including insufficient public involvement, thermoelectric wastewater discharge into the aquatic environments because of subpar and outdated cooling systems, the existence of misstatements and exclusions in the EIA report, and the study's inability to reveal mitigation strategies for the pollution caused by coal handling and storage. The appellants also wanted the decision by NEMA granting the 2<sup>nd</sup> respondent the EIA license to be set aside.<sup>673</sup>

At first NEMA had given conditions to the 2<sup>nd</sup> respondent on the EIA license, but then NEMA proceeded into giving the license without considering the conditions and comments. The court found that the conditions given were inadequate which showed a casual approach of the same by NEMA. Thus, the court allowed the appeal by citing the case of *Mohamed Ali Baadi*<sup>674</sup> which delved on section 129(1)(a) of EMCA and established that inadequate meaningful public participation would vitiate the EIA procedure. In relying on this case, the court found that the respondent's EIA study to be incomplete due to lack of meaningful public participation.<sup>675</sup> The tribunal further ordered NEMA to adhere to Regulations 17 and 22, to effectively interact with lead agencies and the community, and to adhere to the stringent timelines stipulated by the aforementioned Law.<sup>676</sup>

<sup>672</sup> Jamal Ahmed Ali & 5 others vs NEMA & Another, Tribunal Appeal no.NET 196 of 2016

<sup>673</sup> Ibid

<sup>674</sup> Mohamed Ali Baadi and others vs the Hon. Attorney General and 7 others (HCCC Petition NO 22 OF 2012)

<sup>675</sup> Jamal Ahmed Ali & 5 others vs NEMA & Another, Tribunal Appeal no.NET 196 of 2016

<sup>676</sup> Ibid

### 3.4.3 Duplicity of roles

Duplicity of roles precisely refers to a situation where two or more institutions are allocated similar functions by legislation(s). The term duplicity possesses its foundation from a latin word, “twofold” meaning having two parts.<sup>677</sup> An example of this in governance of industrial wastewater is seen in EMCA and in the Water Act.<sup>678</sup> The Sustainable Waste Management Act also seeks to govern waste management which includes industrial waste.

EMCA establishes NEMA<sup>679</sup> to receive applications from persons intending to discharge wastewater or other contaminants into the surroundings and to consider the possible effects before issuing the EDL.<sup>680</sup> NEMA also ensures that the EIA is undertaken and the correct procedure has been followed before issuing the EIA License including public involvement.<sup>681</sup>

Just as is the case with NEMA, WRA is bestowed with the responsibility of issuing water permits.<sup>682</sup> Thus an industry just can’t discharge effluent any how into water resources without permit from the Authority otherwise it would be a crime.<sup>683</sup> Further, the Authority requires that relevant EIA studies be undertaken and with the public involvement before the issuance of any water permits.<sup>684</sup> The permits so issued can also be varied or canceled where it’s shown that for instance the water quality of the water resource has deteriorated on account of effluent discharge.<sup>685,686</sup> WRA is accountable for developing and implementing excellence, the cause of action, and regulations for water resource control and usage. It is also responsible for enforcing the Act's provisions and coordinating with other regional, national, and international authorities to guarantee improved water resource management and usage control.<sup>687</sup> WRA's other major responsibilities include issuing wastewater discharge permits and monitoring the quality and quantity of effluent discharged by enterprises, which can briefly be said to be enforcing

<sup>677</sup> See at;<<https://www.vocabulary.com/dictionary/duplicity> >accessed 11 October 2022

<sup>678</sup> No.43 of 2016

<sup>679</sup> Section 7

<sup>680</sup>EMCA 1999, section 75

<sup>681</sup> Jamal Ahmed Ali & 5 others vs NEMA & Another (Tribunal Appeal no.NET 196 of 2016)

<sup>682</sup>Water Act, section 36(c).

<sup>683</sup> Ibid, section 38(1).

<sup>684</sup> Ibid, section 40(4).

<sup>685</sup> Ibid, section 46(1).

<sup>686</sup>Water Act of 2016. Section 11.

<sup>687</sup> Ibid. Section 12.



industrial water usage regulations, particularly when those industries release their effluents into water resources.<sup>688</sup> It is crucial to say that these are still the obligations under EMCA as well as stipulations in the Constitution with respect to environmental management as discussed earlier. The sharing of functions between NEMA, WRA, and WASREB is what brings about duplicity of roles. Furthermore, Sustainable Waste Management Act provides for more or less same provision but at length. The new legislation is effective but not yet fully operational on account of subsidiary legislation and regulations to be enacted under it.

According to Section 156(5) of the Water Act, the EMCA's clauses for protecting and conserving water resources and controlling water contamination must be applied according to the pertinent provisions of the Water Act, with the exclusion of situations where WASREB fails to fulfill its obligations under the Water Act. This provision seeks to prevent the existence of any overlap in exercising the provisions under EMCA on water pollution and those under the Water Act, by WRA, NEMA and by the WASREB. It thus becomes interesting to check the working/implementation of this section on the ground, in light of the procedures under each legislation as discussed above.

### **3.5 Conclusion**

The problem of environmental control is shown to be of great importance; <sup>689</sup> it has direct influence to the theory of rights and justifiable growth.<sup>690</sup> Therefore, there is the need for a long-lasting solution for the challenges addressed above and for many more that are addressed in chapter 2. This is because environmental issues have become very complex with serious impacts on climate change and biodiversity. Such effects affect human, animal and plant life. Further, the regulatory framework should be in place to deal with the situation at hand or serve the needs as per the utilitarian approach. Where the law seems not to work, then Parliament through the delegated power by the people should make necessary amendments or pass new and better legislation.

With respect to this study, adequacy of a regulatory framework considers a number of factors.

<sup>688</sup> *ibid.*

<sup>689</sup> Kariuki Eddy Gatui. *Global Strategy Implementation Challenges of Kenya's Multilateral Environmental Agreements with the United Nations Environment Programme in Nairobi Kenya*. 2008, page 1.

<sup>690</sup> Kariuki Muigua. *Nurturing our Environment for Sustainable Development*. 2016, pages 46-47

For instance, are there laws in place addressing the concern? Are there institutions established for implementation purposes? Does the law in place provide for implementation procedures? Are there any monitoring mechanisms in place? Does the law provide for penalties in case of default and the enforcement mechanisms?

In looking at adequacy of the regulatory framework, the above questions can be answered in the affirmative with respect to the Kenyan situation. In fact, as noted earlier on, Kenya has elaborate provisions in the Constitution with respect to environment protection and waste management. Kenya also has number of pieces of legislations as noted in this chapter with provisions dealing with industrial waste water or waste management. The various pieces of legislations establish institutions to implement them and further empowered to undertake several actions upon industries.

Kenya also has a robust judicial system and specific courts were established to deal with environmental issues and grievances. This shows how matters environment have been given importance in Kenya. This is not to say that the regulatory framework is smooth with no setbacks, because despite the laws, institutions in place, industries still flaunt the law as noted in chapter 2. Implementing institutions such as NEMA have at times failed in their mandate as noted earlier. Challenges such as corruption and those noted in chapter 2 and in this chapter, all affect the adequacy and effectiveness of the regulatory framework on industrial effluent management.

Nonetheless, despite the setbacks, the regulatory framework as it is currently is workable. In that industries should as such find no difficulties complying with the law. What seems to hail this sector most, seems to be a certain negative culture. Culture of complacency. Culture of non-compliance. Culture of corruption. Culture of failure to protect the water resources just for its intrinsic value. Culture of living for today and letting tomorrow deal with itself.

The long-lasting solutions are to remedy challenges like limited resources, weak national level environmental governance system, ineffective coordination of institutions, and country characteristics that impact on the implementation process <sup>691</sup> and waiving of important requirements in the various procedures for environmental monitoring by the institutions

<sup>691</sup> Kariuki Eddy Gatuiri, 'Global Strategy Implementation Challenges of Kenya's Multilateral Environmental Agreements with the United Nations Environment Programme in Nairobi Kenya' (2008)p.1 2

responsible. There is therefore a manifest need in some of the legislations and the functions performed by the various institutions to avoid the scenario of duplicity and to reduce complexity of the legal or regulatory framework. Also, there is need for continuous sensitization of industries and people water resources conservation and more so on industrial waste water reuse and recycling. The challenges pointed out herein affecting the legislative and institutional framework must however be addressed.

## **4.0 CHAPTER FOUR: INDUSTRIAL EFFLUENT MANAGEMENT: LESSONS FROM THE CASE OF UGANDA AND SOUTH AFRICA**

This chapter addresses effluent management in Uganda and South Africa. Both countries are in Africa with Uganda being our immediate neighbor to the west whereas South Africa is down south as the name suggests. These two countries differ in a number of aspects such as their legal systems. Whereas Uganda just like Kenya is a common law country, South Africa has a mixed or hybrid common law system as it draws influence from various other systems. Industrially, economically and technologically wise, South Africa leads. So, it becomes interesting to know what these two countries are doing with respect to industrial effluent management and lessons that Kenya can draw from the two, being more or less in the middle. The part seeks to identify the failures, tribulations, successes and innovations from the two countries in the region of industrial waste water control. Various industrial parks will be highlighted such as the Kampala Eco-Industrial Business Park (KIBP), which is said to be Uganda's most ambitious (eco)industrial park yet, still under development in line with Uganda's industrial development goals. The Limpopo Eco-Industrial Park (LEIP), which seeks to modernize industrial effluent management in South Africa, the Lords View Eco-Industrial Park and the Chem City Eco-Industrial Park will also be considered and the steps made towards environmentally friendly industrial system in South Africa and Uganda. The chapter will end by giving a general conclusion for both South Africa and Uganda.

### **4.1 Introduction**

Globally, waste management has always been a problem with the high level of industrialization across the universe, point to note is that environmental concern is not limited to industrial development.<sup>692</sup> With their factory production and wastewater, corporations are known to contribute to biological, mineral, and aesthetic water contamination.<sup>693</sup>

<sup>692</sup> UNIDO, 'Implementation Handbook for Eco-Industrial Park' (2017) P.1

<sup>693</sup> John Omung'ala Aywa, 'Suitability of Athi River water for irrigation within Athi river town and its environs' (2017) p.7

Every country and person is required to ensure sustainable resource use.<sup>694</sup> With respect to this, South Africa and Uganda have been employing treatment of waste, re-using, use of sewerage and septic tanks and the marine outfalls in South Africa to manage waste and to curb against environmental degradation.

The inability of some garbage to be reused further and the fact that not all waste collected can be recycled make the aforementioned solutions insufficient.<sup>695</sup> Also the treatment mechanisms could not sufficiently remove some of the compounds present in effluent discharged by industries like heavy metals, and thus making the use of treated effluent to be dangerous to individual health.<sup>696</sup> South Africa can be said to be leading in innovation when it comes to waste management; it has several eco-industrial parks with well-defined mechanisms for waste management and has recently launched the Limpopo Eco-Industrial Park which aims at using plasma gasification to promote zero waste production.<sup>697</sup>

The two countries, Uganda and South Africa, have also tried to make their policies and regulatory structure more reliable in dealing and encouraging the entitlement to a safe and clean environment. Project proponents must seek effluent discharge license as a national requirement for them to be allowed to discharge effluent to a sewer or water resource. For example, the Hout Bay marine outfall in South Africa which operates sewerage and effluent discharge systems had to seek for a discharge permit as a national requirement for it to be allowed to discharge into the ocean.<sup>698</sup>

<sup>694</sup> For instance, Article 69 of Kenya's 2010 constitution outlines the country's environmental obligations, which include the responsibility for everyone to work with government agencies and other individuals to preserve the environment, conserve it, and ensure that natural resource use and growth are ecologically sustainable.

<sup>695</sup> Ibid (n 212) page 110

<sup>696</sup> See "A study of treated wastewater, (2016)," a study conducted to determine the quantity of contaminants eliminated by Cape Town's water reuse and wastewater treatment facilities and to detect emerging pollutants of concern in regained potable water. <[Cape Town Waste Water | Water Stories](#) >accessed 11 June 2022

<sup>697</sup> Lords View Industrial Park - 3 Poplar Crescent Chloorkop Ext 66 Midrand Gauteng, 'Property description by agent Raymond Lurie' page 1-2 <<https://curriegrup.co.za/properties/features/pdf/?pid=537> >accessed 6 July 2022.

<sup>698</sup> Greater Cape Town Civic Alliance website, 'City of Cape Town's sewerage: The report that caused the stink, posted by Webwolly' (15<sup>th</sup> June, 2015)

## 4.2 Industrial effluent management in Uganda

Uganda is a landlocked nation in East Africa that was conquered by the British. Its unique terrain includes the towering Lake Victoria and the snow-capped Rwenzori Mountains. Despite the manufacturing sector's continued expansion, enough attention to commercial waste control has not yet been paid.<sup>699</sup>

The industrial history traces back to the years following independence that is 1952-1962.<sup>700</sup> The years saw a dramatic industrial growth in Uganda but then declined precipitously in the 1970s.<sup>701</sup> Uganda gained stability by 1990s with the Uganda Investment Authority (UIA) being in charge and since then foreign companies have been making investments in Uganda. Mention the production of iron ore and other materials, chemicals and agrochemicals, medications, chemical products and petroleum, agro-processing, power, and biodiesel, among other things.<sup>702</sup> With significant businesses dependent on processing farm goods like tea, tobacco, sugar, cocoa, cotton, cereals, milk products, and oil seeds, manufacturing only makes up a minor fraction of Uganda's gross domestic product. Additionally, manufacturing includes the production of beer as well as cement, fertilizers, matches, metal goods, paints, shoes, soap, steel, textiles, and automobiles.<sup>703</sup>

Factories produce significant amounts of solid effluents, which were found to be dumped into the environment uncontrolled in 2011 and cause environmental damage.<sup>704</sup> The same case seem to be in existence following the research done in January 2017 by Chinaza Godswill Awachi & Igwe S Victory.<sup>705</sup> The analysis found that irresponsible garbage dumping was frequently

<sup>699</sup>Godswill, A. C. (2017). Industrial waste management: brief survey and advice to cottage, small and medium scale industries in Uganda. p. 3

<sup>700</sup> National Planning Authority, Industrial Evolution in Uganda. Makerere University, Department of Political Science and Economic Policy Research Centre, Kampala, School of Economics Makerere University,

<sup>701</sup> Omari H. Kokole, 'Republic of Uganda' (Britannica. 2021)para

1&2<<https://www.britannica.com/place/Uganda/Economy#ref37610>>accessed 12 May 2022

<sup>702</sup> Morrison Rwakakamba (Uganda's Investments Authority Chairman), 'Uganda's industrial journey, achievements and progress' (26January2022)

<sup>703</sup>ibid

<sup>704</sup> Walakira, P., & Okot-Okumu, J. (2011). Impact of industrial effluents on water quality of streams in Nakawa-Ntinda, Uganda. *Journal of Applied Sciences and Environmental Management*, 15(2). abstract, para.1&2

<sup>705</sup> Godswill, A. C. (2017). Industrial waste management: brief survey and advice to cottage, small and medium scale industries in Uganda. page 22

practiced in Uganda without consideration for the effects on human health or ecological pollution, which is currently one of the causes of environmental contamination in Uganda.<sup>706</sup>

The administration of Uganda's water resources, agricultural water supplies, urban water supplies and sewage, as well as water for productivity and hygiene, was handled by a variety of government agencies and public agencies in 2009.<sup>707</sup>

The sanitation sector has various departments.<sup>708</sup> For the purpose of this chapter I will dwell on two departments which are most connected to industrial effluent management. NEMA handles the body that ensures that the laws are followed on expelling wastewaters into public waterbodies. The National Water and Sewerage Corporation manages to supply wastewater services to urban centers across the nation.<sup>709</sup>

For the purpose of this chapter I will give attention to KIBP because it has a major goal of providing accessibility in delivery of services, business establishment and proper waste management.<sup>710</sup> If the KIBP will make it to 100% operation then Uganda will be much closer to attaining her goals on economic and industrial development and sustainability, which is an issue of national concern to make sure that the activities do not harm the environment in areas outside their scope.<sup>711</sup>

#### **4.2.1 Policy and regulatory framework**

The legal framework for waste management is summarized as follows:<sup>712,713</sup> According to the Constitution, parliament must enact laws that will safeguard the environment from exploitation, contamination, and destruction, manage it for environmental sustainability, and raise public knowledge of environmental issues.<sup>714</sup> The Constitution forms the foundation for all the legislations regarding a clean environment, sustainable development and balancing development

<sup>706</sup> Ibid

<sup>707</sup> Ibid (n 726) p. 35

<sup>708</sup> Ibid

<sup>709</sup> Ibid

<sup>710</sup> See <[https://maps.prodafrica.com/economic\\_areas/uganda/central-region-ug/seeta/industrial/kampala-industrial-business-park-kibp-kampala-uganda/](https://maps.prodafrica.com/economic_areas/uganda/central-region-ug/seeta/industrial/kampala-industrial-business-park-kibp-kampala-uganda/)> accessed 3 July 2022

<sup>711</sup> The Stockholm Declaration of 1972, present principles on Environmental issues, Principle 21

<sup>712</sup> Tilenga Feeda's Legislative, policy and administrative framework, permitting requirements, and international conventions, standards, guidelines and agreements. (Feb2020 )p. 1-96

<sup>713</sup> which is a result of the amendment done on 5<sup>th</sup> January, 2018. Laws. Africa Legislation Commons.

<sup>714</sup> Constitution of Uganda 2018. Article 245

in Uganda.<sup>715</sup> The summary provided above from the Constitution still delves within the principles of environmental protection as provided for in the EMCA of Kenya.<sup>716</sup> Moreover, it coincides with the ruling of the European Court of Human Rights in *Spain vs Lopez Ostra*.<sup>717</sup> The court interpreted Article 8 of the European Convention for Protection of Human Rights and Fundamental Freedoms<sup>718</sup> to include the entitlement to a healthy environment. The country and private organizations are required under this right to safeguard the environment and the liberties that flow from it. This is due to the possibility that extreme environmental pollution may adversely impact people's health in some way and hinder them from enjoying their houses, which affects their personal and family lives.<sup>719</sup>

As a result, the Ugandan Constitution gave rise to a number of laws that deal with wastewater management, environmental preservation, and rights related to the environment without compromising the three pillars of sustainability. The same are highlighted below:

Water (Waste Discharge) Regulations (SI No. 152-4), regulation 4 (1) which prohibit every person from discharging effluents on property or into water sources contrasting the provisions of the law.<sup>720</sup> Regulation four further requires that any person intending to treat, transport or storage of both hazardous and non-hazardous waste, must have a license.<sup>721</sup>

There is then the NEMA (National Environment (Waste Management) Regulations (SI No. 153-2) Regulation) 6 which provides for several requirements with regards to collection, transporting and storage of waste. This includes the requirement of a license to transport and store waste as shown above.<sup>722</sup>

There is also the Water (Garbage Release) Ordinance, which establishes restrictions on actions for which waste release permits are required to be obtained. These restrictions include the license

<sup>715</sup> Twesigye Morrison Rwakakamba, 'Effective are Uganda's Environmental Policies?'. 2009. Pp. 5-6

<sup>716</sup> Of (1999) of the laws of Kenya section 3(5)

<sup>717</sup> (1994). 303 Eur. Ct, H.R. 41

<sup>718</sup> Which states that, "everyone has the right to respect for his private and family life, his home and his correspondence."

<sup>719</sup> Kariuki Muigua, 'Nurturing Our Environment...P.51

<sup>720</sup> Regulations 3 and 4(1) of the Water (Waste Discharge) Regulations (SI No. 152-4).

<sup>721</sup> Water (Waste Discharge) Regulations (SI No. 152-4), Regulation 4(1), which state that, "a license for transportation, storage and treatment of hazardous or nonhazardous waste is a requirement"

<sup>722</sup> NEMA (National Environment (Waste Management) Regulations (SI No. 153-2) Regulation) 6 and regulation 13(1)



for the release of wastewater or waste into water or land.<sup>723</sup> Also it is required that if the project will generate waste throughout its life cycle, then waste management plan and strategy must be developed as part of the ESMP.<sup>724</sup>

Then there is the Water Act, whose principal goals include preventing contamination and promoting the secure storage, handling, and waste disposal that could endanger public health and the environment.<sup>725</sup> The Act also sets out the protection and pollution measures and requirement of a permit for discharge and water abstraction.<sup>726</sup> The framework for wastewater management in Uganda is similar to that of Kenya especially in the requirement of the waste discharge permit and public involvement in carrying out the ESMP and EIA. Also, there is the obligation for the State to safeguard the surroundings just as it is in Kenya's Constitution.<sup>727</sup>

#### **4.2.2 Effluent produced by industries in Kampala and in KIBP**

The city of Kampala hosts industries like the Reco industries limited which is a food processing industry, the Rene industries limited for pharmaceuticals, the steal and tube industries and the Tian yi plastic industry.<sup>728</sup>In the KIBP some of the industries include but are not limited to, those close to Namanve stream which are Century Bottling company and Rwenzori Bottling company.<sup>729</sup>

These companies produce enormous amounts of effluent that are dumped into neighboring river systems without being cleaned up, potentially lowering the quality of the water.<sup>730</sup> As an illustration, consider the beverage sector, which uses raw ingredients including protease, lactate, benzene, and fungi that result in effluents with slightly low PH values.<sup>731</sup>

<sup>723</sup> Water (Waste Discharge) Regulations (SI No. 152-4), regulation 4(1)

<sup>724</sup> Ibid

<sup>725</sup> Water Act (Cap 152 of the Laws of Uganda). Section 8

<sup>726</sup> Ibid

<sup>727</sup> Article 69

<sup>728</sup> See <;

<https://www.google.com/search?q=industries+within+Kampala+uganda&og=industries+within+Kampala+uganda&ags=chrome..69i57j0i546l3j0i30i546j0i546.15076j0j7&sourceid=chrome&ie=UTF-8> >accessed 5 September 2022

<sup>729</sup> Christopher Angiro, Patric P'Odyek Abila & Timothy Omara,' Effects of industrial efuents on the quality of water in Namanve stream, KIBP, (2020), p.1

<sup>730</sup> Ibid

<sup>731</sup> Ibid page 3

Waste produced in KIBP can categorically be presented on percentage measures to be 18% metallic, 63% biodegradable, 16% non-biodegradable and 3% hazardous waste which is composed of large volumes of Lead and Chromium.<sup>732</sup>

The waste produced can also be analyzed by nature or type of the waste and the industry responsible. Like in KIBP, 3% of the waste produced is chemical waste from food processing industries, paints, and cement industries, 22% is from human sanitary waste, 18% from coffee processing plant at Kyagulanyi coffee Ltd, 6% from leather and rubber industries, 18% from metal industries which includes but not limited to steel and tube industries, automobile industries, roofing mills and metal fabrication workshops.<sup>733</sup>

Wastewater is also among the waste produced by most industries in Kampala by industrial processes. A study conducted in 2018-2019 by Anabwe John on the downstream and on the Bukasa swamp showed that wastewater contributes 55.7% and 96.7% change in water quality in the downstream and in the Bukasa swamp respectively.<sup>734</sup> This result is said to have been propelled by the fact that wastewater mostly contains COD, BOD, oil and grease, chloride ions, heavy metals like iron, chromium, copper and cadmium.<sup>735</sup>

#### **4.2.3 Industrial effluent management measures by industries in Kampala and in KIBP**

Industries in Kampala city include inter alia, the cement factories, chemical factories, breweries industries, steel factories, oil industries company ltd, tobacco companies and distillers.<sup>736</sup>

Wastewater management has been a challenge in Kampala city. It was noted in 2008 that a persistent lack of resources to link new projects to major sewage pipes, the dumping of untreated sewage into pipes, unregulated rain water, and effluent contamination, particularly in Lake Victoria, all contributed to a rise in water-borne diseases.<sup>737</sup>

<sup>732</sup> Omara, T., Othieno, N., Obonge, J., Ssebulime, S., & Kansime, M. (2019). Characterization and Prognostication of Wastes Generated by Industries in Kampala Industrial and Business Park—Namanve. *Open Access Library Journal*, 6(4), 1-15. abstract, para.1

<sup>733</sup> Ibid

<sup>734</sup> See <<http://makir.mak.ac.ug/handle/10570/7823>>accessed 6 September 2022

<sup>735</sup> Anabwe John, (2019) < <http://makir.mak.ac.ug/handle/10570/7823>>accessed 6 September 2022

<sup>736</sup> Manufacturing Companies in Kampala Uganda

<sup>737</sup> ESIA, Kampala Sanitation Programme Country: Uganda Project Number: P-UG-E00-008 (July 2008) Page2.

Therefore, a sanitation program was proposed to provide a waste water collection system.<sup>738</sup> This was done to improve hygiene in the Kampala area, hence lowering the danger of sickness brought on by microbes in the effluent, and to expand the sewage collection expansion area using suitable sewer materials. This was done to enhance the well-being of the public, the hygiene of buildings, and the ability of industries to link to the sewer network system.<sup>739</sup>

The sanitation programs proposed in 2008 have still not guaranteed the residents of Uganda 100% access to safe drinking water because of the continued effluent dumping including human waste and fertilizers into water sources because of inadequate sewer systems.<sup>740</sup>

#### **4.2.4 Effects of the waste produced to flora and fauna**

According World Air Quality Report, Kampala is among the most polluted cities in the world, with pollutant levels up to seven times greater than those considered safe by the World Health Organization.<sup>741</sup> On that note, it should not be a surprise to find that there is also high level of wastewater discharge into water sources causing degradation of water quality. On 13<sup>th</sup> March 2022 Hamza Kyeyune reported that the activities carried out by the residents settling on Rwizi river banks caused a lot of water pollution to the river through their activities and the main source of water pollution was identified to be the industries through their effluents.<sup>742</sup>

When wastewater rich in BOD, and COD from industries and other sources is discharged into natural systems, this makes it impossible and difficult for aquatic life to exist and also hampers their normal functioning by exerting pressure for oxygen available.<sup>743</sup> COD makes it impossible for organisms to survive, and interferes with the process of osmosis, which sustains plant life.<sup>744</sup> Untreated discharged industrial effluent is associated with destroying the natural habitat for aquatic organisms.<sup>745</sup>

<sup>738</sup>Ibid

<sup>739</sup> Ibid P.12

<sup>740</sup> Tara Hudson, 'The water crisis in Uganda: realities and solutions (27<sup>th</sup> March, 2021)

<sup>741</sup> Reuters. 2022. Ugandan Researchers Develop Low-Cost Sensors to Track Air Pollution

<sup>742</sup> Ugandan River dying from pollution,2022.

<sup>743</sup> Consultancy Services for SEA, Study in the masterplan for the Leather Industrial Park proposed at Kinanie- Athi River, Machakos County (November 2015) Page118

<sup>744</sup> Ibid

<sup>745</sup> Kiongo, P. K., Wahome, C. N., Muthama, P. M., Muhonja, J., Ngumba, L., Hassan, F., & Momanyi, E. (2021). Evaluation of Effluent Discharge from Steel Manufacturing Industries on the Proliferating Environmental Degradation in Nairobi Metropolitan in the Republic of Kenya. *Journal of Geoscience and Environment Protection*, 9(9), 198-226.

Wastewater from processing industries and which is rich in heavy metals causes degradation of water quality if discharged without any pre-treatment measures taken and a good example is in the downstream and in the Bukasa swamp.<sup>746</sup> Presence of heavy metal ions in water causes chronic diseases to human beings like cancer, gastrointestinal illness, urinary infections and dysfunction and even paralysis,<sup>747</sup> and water-borne disease.<sup>748</sup> Additionally, this can result in the bio-accumulation of copper ions in mammalian tissues.<sup>749</sup>

According to reports, Namanve's chemical waste from the food processing, cement, and paints industries poses grave risks to the environment. This is because some of this waste easily ignites/reacts to cause corrosion or even toxic effects to human beings and to the environment.<sup>750</sup> Untreated effluents from beverage industries cause pH changes in water. Slightly high pH makes water to be slippery while low pH makes water to have a bitter taste or even to have a metallic taste.<sup>751</sup> This is a justification of the fact that industrial effluents if discharged without taking pre-treatment measures is likely to cause degradation of water quality. In addition to that, discharged raw effluents may lead to an increase in excessive levels of nitrogen which may cause a rise in environmental concerns such as nutrient enrichment, algae growth, ischemia, ocean acidification, ammonia saturation in forests, and climate change.<sup>752</sup>

As a result there are measures put in place for industrial effluent management which include those mentioned by Mukwaya John Christopher in his thesis,<sup>753</sup> which include but not limited to; collection of municipal wastewater from the points where it is generated for disposal,<sup>754</sup>

<sup>746</sup> Anabwe John, (2019) < <http://makir.mak.ac.ug/handle/10570/7823> > Accessed 6 September 2022

<sup>747</sup> Kosgey, J., Koech, J., Bunyasi, S., Kipkemoi, B., Muthoka, T., & Nyabaro, O. (2015). Determination of Heavy Metals Pollutants in Sediments along the Banks of Athi River Machakos County, Kenya.

<sup>748</sup> Nadir, S., Tole, M., Dharani, N., & Wafula, G. (2020). Effectiveness of a Wastewater Treatment Plant located at EPZ in reducing Pollutants Discharged into River Athi, Kenya. p.1

<sup>749</sup> Shadrack Mulei Kithiia, (2010) P.522

<[file:///C:/Users/pc/Downloads/Water\\_Quality\\_Degradation\\_Trends\\_in\\_Keny.pdf](file:///C:/Users/pc/Downloads/Water_Quality_Degradation_Trends_in_Keny.pdf)> accessed 24 June 2022.

<sup>750</sup> Omara, T., Othieno, N., Obonge, J., Ssebulime, S., & Kansime, M. (2019). Characterization and Prognostication of Wastes Generated by Industries in Kampala Industrial and Business Park—Namanve. *Open Access Library Journal*, 6(4), 1-15.

<sup>751</sup> Christopher Angiro, Patric P'Odyek Abila & Timothy Omata, 'Effects of industrial effluents on the quality of water in Namanve stream, KIBP, Uganda' (2020) pp.3-4.

<sup>752</sup> Ibid page 5

<sup>753</sup> Mukwaya John Christopher, 'Municipal Wastewater Management in Kawempe Division, Kampala Capital City Authority' (Bachelor's thesis April 2013 Environmental Engineering) pages 21

<sup>754</sup> Ibid pages 21-22

treatment of wastewater before it is released in the natural environment.<sup>755</sup> Recycling and reusing of waste produced by industries is also advocated for in Omara Timothy's work.<sup>756</sup>

#### **4.2.5 Effluent treatment methods applied by industries in Kampala and in KIBP**

Uganda has the Bugolobi-Nakivubo wastewater treatment plant that operates effectively.<sup>757</sup> There is also the Kinawataka Pre-Treatment Plant (PTP), which collects the untreated wastewater and to remove any solid.<sup>758</sup> The waste is transported through a load transfer hydroelectric plant, an intake screw cranking channel, a physical pre-treatment with fine and course screens and aerated grit reduction to biological treatment and odor treatment.<sup>759</sup>

The Nakivubo Wastewater Treatment Plant (WWTP), located in Bugolobi, consists of two air intake screw fueling stations, tactile pre-treatment with fine and coarse screening and aerated grit expulsion, principal clogging, anoxic therapies in highly efficient trickling filtration, supplementary filters, physical raw sewage bulking, anoxic thermophilic sludge fixation, biomethane energy production, physical raw sewage water exfoliator, as well as odour purification.<sup>760</sup>

The procedure for wastewater treatment begins with the industrial waste being sieved, removal of grift, neutralization, aerobic(with oxygen)/anaerobic(without oxygen) reactions, sedimentation and then to discharge.<sup>761</sup> Comprehensively the process begins by what is called the total treatment, at this stage effluent from industries is treated, then to pre-treatment stage where insoluble particles are removed before reaching the main treatment stage so as to prevent such particles from hampering with the treatment process.<sup>762</sup> Then to primary treatment where suspended solids are removed by coagulation, then to secondary treatment where chemicals are reduced by aerobic and anaerobic reactions into sludge and lastly to the tertiary treatment where

<sup>755</sup> Ibid

<sup>756</sup> Ibid (n 771)

<sup>757</sup> Afrik 21. 2021. The Bugolobi-Nakivubo wastewater treatment plant is now operational.

<sup>758</sup> Uganda, Wastewater Treatment Plant Bugolobi, website < [GKW Consult: Uganda, Wastewater Treatment Plant Bugolobi \(gkw-consult.com\)](http://GKW Consult: Uganda, Wastewater Treatment Plant Bugolobi (gkw-consult.com))>accessed 11 June 2022

<sup>759</sup> Ibid

<sup>760</sup> Ibid

<sup>761</sup> Phil.bettary, (November,2017) <[Presentation Template \(sia-toolbox.net\)](http://Presentation Template (sia-toolbox.net))>accessed 11 June 2022

<sup>762</sup> Ibid

residual components such as colors and sludge remains are removed resulting into a clear water with the specified environmental standards required.<sup>763</sup>

As per Afrik 21, Uganda's wastewater treatment plant at Bugolobi uses anaerobic respiration in waste treatment process.<sup>764</sup> However the treatment mechanisms are still not sufficient given that only 36% of 378,760 liters of wastewater generated in KIBP is treated per week.<sup>765</sup>

#### **4.2.6 Reusing of waste produced by other industries in Kampala and in KIBP**

Re-using was another method mentioned in Mukwaya John Christopher's thesis, which involves using the aspects of municipal wastewater that are beneficial.<sup>766</sup> In the KIBP, 39 types of waste are produced and 25 types out of them are said to have the capability of being reused by the same or by another industry in the park. The coffee processing plant at Kyagulanyi contributes 18% of the total percentage of waste produced in the park.<sup>767</sup> The coffee plant is said to have put most of the waste produced by the plant into use.<sup>768</sup> This is a good example and a good strategy towards reducing the amount of waste produced in the park.

The bagasse, a byproduct of sugar cane juice processing, is roasted in a high oven, burned, and used as fuel to generate steam at the Sugar Corporation of Uganda Limited (SCOUL).<sup>769</sup> The ash created after burning is combined with filtration cake (mud), which is then utilized as fertilizer or manure for agricultural production. Bagasse is also used to crank turbines for power generation.<sup>770</sup>

In the KIBP over 378,760 liters of wastewater is generated per week and 36% of it is reused within the KIBP after being subjected to treatment mechanisms, the remaining volume is released to the environment which pose a possibility of environmental degradation.<sup>771</sup>

<sup>763</sup> ibid

<sup>764</sup> Ibid (n 777)

<sup>765</sup> Nicodemus Othieno, 'Prospecting the waste generation among industries in Kampala industrial and business park' (May 2017) p.V

<sup>766</sup> Mukwaya John Christopher, 'Municipal Wastewater Management in Kawempe Division, Kampala Capital City Authority' p.8

<sup>767</sup> Ibid

<sup>768</sup> Ibid

<sup>769</sup> Godswill, A. C. (2017). Industrial waste management: brief survey and advice to cottage, small and medium scale industries in Uganda. p.10

<sup>770</sup> Ibid

<sup>771</sup> Nicodemus Othieno, 'Prospecting the waste generation... (May 2017) p. V

#### **4.2.7 Recycling of wastewater by industries in Kampala and in KIBP**

Recycling involves a process where effluent streams and manufacturing procedures are examined to recognize chances; reusing relates to the principle of material exchange which aims at reducing the cost for raw material, disposal cost and to conserve natural resources.<sup>772</sup>

Otieno Nicodemus in his work showed that about 3205.9 tons of waste is annually generated in the KIBP and 63% of it is biodegradable, while 37% of the waste generated in KIBP is recycled.<sup>773</sup>

#### **4.2.8 Challenges in Kampala and in KIBP**

The absence of national regulations on hygienic use of wastewater in agriculture, low general understanding of sewage use, cultural attitudes/negative perceptions of effluent use, the outdated technology currently in use, the fact that the treatment works only serve 10% of Kampala's Central Business District, and the high cost of connection services for most customers are just a few of the factors limiting the effectiveness of wastewater treatment since 2012.<sup>774</sup> By creating policy standards on the use of effluent in agriculture, educating families about how effluent could be used in agricultural production and the affiliated possible benefits, and encouraging safe handling of effluent to avoid environmental contamination and disease incidence, the government of Uganda can ensure the effectiveness of wastewater treatment programs.<sup>775</sup>

The KIBP itself does not issue a system for effluent control for the current inhabitants beside it being the largest project in Uganda. Thus the new occupiers have been proposing for a contractor licensed to collect, remove and dispose of their waste.<sup>776</sup> The ESIA,<sup>777</sup> shows that during construction there will be a lot of wastewater generated from short-term assembly compounds which will cause contamination of surface and fresh water, and specifically to pollution of lake Victoria due to it being close to the industrial park.<sup>778</sup> However, the ESIA of 2019 still was silent

<sup>772</sup> Godswill, A. C. (2017). Industrial waste management: brief survey and advice to cottage, small and medium scale industries in Uganda. p.12

<sup>773</sup> Ibid (n 791) p.V

<sup>774</sup> Ronald Kato Kayizzi, Tom Damulira Tomusange, Kerudong Acayerach Paskwale, 'Wastewater Production, Treatment, and Use in Uganda,' (Session3b\_CountryReport\_Uganda.pdf 10 October 2012) p.4

<sup>775</sup> Ibid

<sup>776</sup> Queensland & Leeds Consulting Engineers Ltd.' KIBP Infrastructure Scheme ESIA Volume II: Main ESIA Report (June 2019) p. 244

<sup>777</sup> Environmental and Social Impact Assessment

<sup>778</sup> Ibid (n 796) p.248)

on the mitigation measures to remedy the pollution that was to come in during the operation stage.<sup>779</sup>

In addition to that, Timothy Omara *et al*,<sup>780</sup> showed the percentage of waste produced by the KIBP per week to include; 18% metallic waste, 3% chemical hazardous waste, 16% non-biodegradable and 63% biodegradable waste.<sup>781</sup> The management approaches as per the journal,<sup>782</sup> was proper collection and transfer of waste and also that KIBP recycles about 37% of the waste produced.<sup>783</sup> The journal also indicated that the future prediction on waste production can triple since only 22 industries were in operation by 2019 out of 87,<sup>784</sup> and also that KIBP lacks central incineration plant. Therefore, Timothy Omara *et al* joined issue with the earlier on proposed idea requiring the National Water and Sewerage Corporation to take responsibility of waste management in KIBP.<sup>785</sup>

Christopher Angiro and colleagues carried out a second investigation in April 2020 with the goal of determining how industrial wastewaters affected the microbiological and physicochemical water quality obtained from four distinct locations anywhere along Namanve stream in KIBP.<sup>786</sup> It showed that industries were still generating volumetric waste and discharge it into the nearby water bodies while untreated.<sup>787</sup> Additionally, it was discovered that the majority of firms still dump untreated sewage into nearby bodies of water because they lack wastewater treatment facilities and are still employing antiquated industrial techniques.<sup>788</sup> The effects of this being degradation of water quality and release of heavy metals and BOD,<sup>789</sup> into water sources.<sup>790</sup>

From the foregoing, the main challenges in Kampala Central Business District (CBD) and in the KIBP can be summarized as follows;

<sup>779</sup> Ibid

<sup>780</sup> Omara, T., Othieno, N., Obonge, J., Ssebulime, S., & Kansime, M. (2019). Characterization and Prognostication of Wastes Generated by Industries in Kampala Industrial and Business Park—Namanve. *Open Access Library Journal*, 6(4), 1-15. abstract, para.1

<sup>781</sup> Ibid

<sup>782</sup> By Omara, T., Othieno, N., Obonge, J., Ssebulime, S., & Kansime, M. (2019).

<sup>783</sup> Timothy (n 800) abstract, para.1

<sup>784</sup> Ibid

<sup>785</sup> Ibid

<sup>786</sup> Effects of industrial effluents on the quality of water in Namanve stream, KIBP, Uganda,

<sup>787</sup> Christopher Angiro, Patrick P'Odyek, Abila Timothy Omara, (April 2020)p.2

<sup>788</sup> Ibid page 2-3

<sup>789</sup> Biochemical Oxygen Demand

<sup>790</sup> Ibid (n 807) p.2&3



### ***Inadequate waste treatment facilities***

Most industries rely on inadequate waste treatment mechanisms and some even lack functional effluent treatment plants, a good example is the beverage industry which discharge raw effluent into Namanve stream and Lake Victoria.<sup>791</sup> In Kampala most of the small and medium industries practise inadequate wastewater management, leading to improper discharge of wastewater which in turn leads to degradation of water quality.<sup>792</sup> Paul Walkira in 2011 cited the work of LVEMP,<sup>793</sup> a study on managing urban and industrial wastewaters in Uganda's Lake Victoria region to show that most industries lack collection and treatment plants, and even if they did, majority of them are now shoddily designed.<sup>794</sup>

### ***Poor handling of by-products and pollution***

Poor handling of by-products in KIBP and pollution due to low implementation of the by-product recycling and reusing system.<sup>795</sup> For example, as per the above analysis only 37% of the waste produced in KIBP is recycled.<sup>796</sup> This means that a great percentage is released to the environment which according to Othieno Nicodemus in his work, remains the major cause of environmental degradation.<sup>797</sup> It should be emphasized that one of the main causes of the decline in Uganda's water quality is industrial contamination.<sup>798</sup> Another example is the Sugar Corporation of Uganda Limited (SCOUL) which due to lack of adequate facilities to prevent carcinogenic substances fails to reduce the amount of these particles, thus releasing waste rich in Carbon, Sulfied and Hydrogen Sulfied into the environment.<sup>799</sup>

<sup>791</sup> Ibid page 1-3

<sup>792</sup> Godswill, A. C. (2017). Industrial waste management: brief survey and advice to cottage, small and medium scale industries in Uganda. p.34

<sup>793</sup> (2002)

<sup>794</sup> Walakira, P., & Okot-Okumu, J. (2011). Impact of industrial effluents on water quality of streams in Nakawa-Ntinda, Uganda. *Journal of Applied Sciences and Environmental Management*, 15(2). p.1

<sup>795</sup> Nicodemus Othieno, 'Prospecting the waste generation...' (May 2017) p.V

<sup>796</sup> By Omara, T., Othieno, N., Obonge, J., Ssebulime, S., & Kansiime, M. (2019).

<sup>797</sup> Nicodemus (n 816)

<sup>798</sup> Walkira Paul & Okot-Okum, (2011) p.1

<sup>799</sup> Godswill, A. C. (2017). Industrial waste management: pp. 27-34

#### **4.2.9 Measures in place to ensure compliance with the regulations by industries in Kampala and in KIBP**

These measures that bind industries and project proponents are in the Constitution of the republic of Uganda, NEMA regulations together with other legal instruments in Uganda. Some of the measures are explained below.

Uganda's Constitution 2018<sup>800</sup> stipulates that Government shall, by legislation, make provisions for actions aimed at encouraging environmental consciousness, managing the environment for ecological sustainability, and protecting and preserving the environment from exploitation, degradation, and disintegration.<sup>801</sup> The Constitution forms the foundation for any legislation dealing with sustainable development and balancing development in Uganda.<sup>802</sup>

Arising from the Constitution are other measures proposed by other legal instruments of Uganda dealing with effluent management, such as the Water (Waste Discharge) Regulations (SI No. 152-4), regulation 4 (1) which prohibit every person from discharging effluents on property or into water sources contrasting the provisions of the law,<sup>803</sup> and acquiring of a license for handling both hazardous and non-hazardous waste.<sup>804</sup> There is also a requirement for a waste discharge license to be acquired by project proponents, and to include a waste management plan in their ESMP.<sup>805</sup>

The NEMA also put in place a requirement for waste treatment and licensing of waste collection and disposal sites.<sup>806</sup>

Compliance with the measures stated above is to be monitored by several institutions in Uganda like NEMA, and therefore, there is a need to sharpen waste management institutions in Uganda including NEMA, just as it was suggested by Morrison R. on the Effectiveness of Uganda's

<sup>800</sup> which is a result of the amendment done on 5<sup>th</sup> January, 2018< Laws.Africa Legislation Commons

<sup>801</sup> Constitution of Uganda 2018. Article 245

<sup>802</sup> Twesigye Morrison Rwakakamba, 'Effective are Uganda's Environmental Policies?' (1 May 2009) pp.5-72

<sup>803</sup> Regulations 3 and 4(1) of the Water (Waste Discharge) Regulations (SI No. 152-4).

<sup>804</sup> According to Regulation 4(1) of the Water (Waste Discharge) Regulations (SI No. 152-4), "a license for transportation, storage, and treatment of harmful or nonhazardous waste is a prerequisite,"

<sup>805</sup> Ibid

<sup>806</sup> NEMA (National Environment (Waste Management) Regulations (SI No. 153-2) Regulation) 6 and regulation 13(1)

Environmental Policies back in 2009.<sup>807</sup> Some avenues and procedures that have played a tremendous role in ensuring compliance with the regulations are discussed below.

### ***The Precautionary principle and Environmental Impact Assessment***

An environment impact evaluation is a methodical investigation to ascertain whether a proposed project would adversely influence environment.<sup>808</sup> On the contrary, the precautionary principle refers to an idea that encourages taking preventive effect before there is comprehensive scientific proof of a risk; that is, action shouldn't be postponed simply because there isn't complete scientific evidence.<sup>809</sup>

The 1982 World Charter for Nature promotes the precautionary principle. It demands that examinations be conducted prior to any operations that could be dangerous to the environment. This means that the project's backers must show that the anticipated advantages outweigh any potential risks or environmental harm; if it appears that the potential negative impacts are not completely comprehended, the activity shall not move forward.<sup>810</sup>

The principle has been the subject of discussion in different jurisdictions. The supreme court of Pakistan preempted what the principle entails and stated that the precautionary approach is not there to wrap the whole project in case it is indicated that the project is likely to cause risk or damage or environmental degradation. Rather, it entails making of adjustments to the project to ensure the welfare or to minimize the possible hazards.<sup>811</sup>

The precautionary principle as a way of enforcing environmental protection and the regulations for environmental protection is applied in Uganda especially where there is a serious threat of environmental degradation.<sup>812</sup> The enforcing tool is always the Environmental Impact Assessment because it addresses the effects of a plan at the initial stage of development and it must be taken by the project proponents subject to public participation.<sup>813</sup>

<sup>807</sup> Twesigye(n 823)

<sup>808</sup> Hawa Nabuuma, 'Examining Environmental Impact Assessment as a mode of implementing the precautionary principle in Uganda,' (June 2019) p.1-3

<sup>809</sup> "The Precautionary Principle" Page1

<sup>810</sup> The 1982 World Charter for Nature, Principle 11b

<sup>811</sup> < <http://escrj.southasianrights.org/judgment/40> >accessed 9 September 2022

<sup>812</sup> Godfrey Nyakana -vs.- NEMA and Others (Constitutional Appeal No. 5 of 2011)

<sup>813</sup> Kenneth Kakuru & Irene Ssekyana,' Handbook on Environmental Law in Uganda' Volume I, 2<sup>nd</sup> Edtn, ( February 2009) pp.31-32

### ***Environmental Audit***

An instrument for assessing whether a project is still carrying out in compliance with the established standards is an environmental audit.<sup>814</sup> By enabling ecological practice supervision and determining adherence to company policies, which include following regulatory standards, it protects the environment.<sup>815</sup>

Therefore, industries or project proponents must conduct regular environmental audits on annual basis and submit the reports on the same to NEMA, to ensure that industries comply with environmental protection regulations in the future and NEMA must also conduct regular inspection on those industries.<sup>816</sup> Through carrying out environmental audits, NEMA will be in a good position to ensure that industrial practices comply with the prediction that was presented in the EIA report, if the EIA was not conducted then environmental audit is to create a leeway on what actions should be taken to encourage adherence to the rules or laws.<sup>817</sup>

### ***Polluter pay principle***

This principle highlights the notion that the polluter must make good on the harm they created, either by completing the necessary physical repairs or by giving the community the necessary financial recompense.<sup>818</sup>

In a land mark case by the supreme court of Uganda, the court informed the jurisprudence of Uganda through a letter on the fundamental principle of polluter pay, and insisted on the fact that a contaminator should reimburse for any harm done to the surroundings and to the casualties of the contamination.<sup>819</sup>

### ***Courts and NEMA***

In his work, Karuba Philip expands on the truth that the National Environment Act gives NEMA the authority to take action to protect the marshlands, among other precautions, by granting rejuvenation orders to offenders and instructing them to return the environment to how it was

<sup>814</sup> Ibid page 32

<sup>815</sup> UNEP, Industry and Environment Office (IEO) (1990) University of Minnesota. Digitized on 5<sup>th</sup> Apr 2071. Length 125 pages, page 1

<sup>816</sup> Kibos Distillers Limited & 4 others v Benson Ambuti Adegga & 3 others [2020]

<sup>817</sup> Kenneth Kakuru & Irene Ssekyaana, pp.31-32

<sup>818</sup> Ibid page 35

<sup>819</sup> Godfrey Nyakana -vs.- NEMA and Others

prior to the intrusion. It also makes sure that developers complete the EIA and present it to NEMA to be approved.<sup>820</sup>

In the case of *Godfrey Nyakana*, the supreme court of Uganda determined that NEMA had the authority to prevent the use of floodplains, to issue recovery orders, and to apply the cautionary and polluter-pay fundamentals to project proponents. Courts have also been vital in preventing environmental degradation. The court thus upheld the restoration order given to Godfrey Nyakana by NEMA which ordered him to destroy his home in less than 21 days.<sup>821</sup>

In conclusion, just as it is with Kenya's Vision 2030, Uganda too seeks to industrialize herself as part of her economic goals. This explains the ambitiousness in the KIBP project which is still under construction. The KIBP is noted to be the biggest industrial hub in Kampala. A number of key lessons stand out with respect to Uganda. First, despite it having plans for a modernized industrial park, the infrastructure for greening has not yet been fully implemented and thus industries still discharge untreated effluent in River Namanve and Lake Victoria.

Secondly, such projects seeking to modernize or to green waste or effluent management need huge funding to make it a success. Such projects entail the employment of newer or better technologies to achieve environmental resource protection and sustainability.

Thirdly as noted in KIBP, about 63% of effluent produced is discharged untreated due to either industry employing old technologies in effluent management as well as industries lacking funds to employ newer technologies. Thus, an industrial park may not succeed in being an eco-industrial park if industries still continue using outdated technologies. Uganda may have to remove the burden of using modern technologies from the industries to the industrial park developers.

Fourthly, for greening or industrial symbiosis to work, then industries must find ways of collating waste, segregating and sorting them depending on reuse as raw materials for another industry. Lack of such strategies in industrial parks, will still lead to more waste being generated and the same being dumped in water resources instead of the resources in the waste being reutilized.

<sup>820</sup> Philip Karugaba, 'A win for the environment' (2015) P.2

<sup>821</sup> Godfrey Nyakana -vs.- NEMA and Others (2011)

Lastly, the success of greening an industrial park may not largely depend on the laws in place but rather the willingness or goodwill on the part of the stakeholders. As it has been seen in Uganda, there is a rather negative culture with recycled waste water. Thus, need for sensitization on the benefits of the same. Also, good planning and availing of funds is a vital requirement.

### **4.3 Industrial Effluent Management in South Africa**

South Africa is a nation furthest to the south in the African continent. It's industrial history dates far back to the days before 1911.<sup>822</sup> This was after when gold and diamonds were revealed in Cape Town which saw the development of the mining and manufacturing industries in the region.<sup>823</sup> South Africa is seen as the ultimate industrialized nation in Africa with food processing industry, service industry, automobile industry, manufacturing industry and mining industry being among the sectors that contribute highly to the nation's GDP.<sup>824</sup> The mining sector is comprises gold, platinum, diamonds, uranium, chromium, zirconium, and vermiculite industries.<sup>825</sup>

However, the high industrialization in South Africa has posed a challenge of pollution to water sources. It is said that in South Africa mining and industrialization are among the major causes of water pollution.<sup>826</sup> Daniel Christoffel Hugo Retief in his thesis,<sup>827</sup> highlighted Oberholster and Ashton's (2008) findings that a significant amount of the sewage coming from South African urban areas is not cleansed correctly before disposal, with the cause being the sewer lines being underdeveloped or the wastewater treatment plants being overwhelmed.<sup>828</sup>

For example, Joan Igamba in his blog shows that coal mining and cleaning has contributed to the water crisis in South Africa by causing water pollution.<sup>829</sup> Consider the coal washing facility near the MNS unplanned settlements, which has exacerbated the country's water issue and delayed the achievement of the country's 2030 goals since none of this can be achieved without

<sup>822</sup> Oliver Schwank, 'Linkages in South African Economic Development. Industrialization without Diversification, South African Industrial Development' (Peter Lang AG, 2010) pp.11-14

<sup>823</sup> Ibid

<sup>824</sup> Ibid

<sup>825</sup> World Atlas Articles.

<sup>826</sup> Daniel Christoffel Hugo Retief, 'Investigating integrated catchment management using a simple water quantity and quality model: A case study of the Crocodile River Catchment, South Africa' (December, 2014) p.1

<sup>827</sup> Ibid

<sup>828</sup> Ibid (n 847)

<sup>829</sup> Water Crisis in South Africa (5<sup>th</sup> July 2022)

water security.<sup>830</sup> The goals comprise, but are not limited to, providing all South Africans with accessibility to safe water in their homes, realizing a deficit in the food trade, with one-third of it coming from local farmers or homeowners, and ensuring household food and nutrition security.<sup>831</sup>

#### **4.3.1 Policy and regulatory framework**

The regulatory structure for industrial effluent management in South Africa, include the Constitution of the republic of South Africa.<sup>832</sup> It has tremendous provisions regarding the environment.<sup>833</sup> For example, it recognizes the right to an atmosphere that is not harmful to health and to have that environment protected for the benefit of future generations through a wide range of policies and laws.<sup>834</sup>

In addition, the Constitution includes social protection, food, water, and medical services as essential amendments in the Constitution of Rights. It demands that appropriate legislative steps be taken to assure the achievement of the aforementioned rights.<sup>835</sup>

When garbage or waste water is thrown into a water source as compared to a local authority's public sewage infrastructure, the National Water Act 36 of 1998 mandates the need for a license.<sup>836</sup> It also calls for a sewage disposal permit to be obtained from the local authority.<sup>837</sup>

According to the Environment Conservation Act, any garbage dumpsite must first apply for a license before it can be built or operated.<sup>838</sup> The Act adds yet another necessity for making a request for a person's authorization to dispose of garbage at a waste disposal facility. Particularly when the applicant wishes to run their own waste site, or conduct any other activities related to waste, they must submit this application.<sup>839</sup>

<sup>830</sup> *ibid*

<sup>831</sup> South African Government, Let's grow South Africa together. The National Development Plan (NDP)2030,

<sup>832</sup> Ian Sampson Deloitte & Touche, 'Introduction to a Legal Framework to Pollution Management in South Africa' (WRC Report No TT 149/01 March 2001) pp.1-209

<sup>833</sup> (1996)

<sup>834</sup> Constitution of the republic of South Africa, 1996, Article 24

<sup>835</sup> *ibid* Article 27

<sup>836</sup> Water Act 36 of 1998, section 43

<sup>837</sup> *Ibid*, Section 22(1)(a)(i) read with Schedule 1 of the Act

<sup>838</sup> Environment Conservation Act 73 of 1989 section 20(1)

<sup>839</sup> *Ibid*, Schedule 1:

The Water Services Act 108 of 1997 further stipulates that in order to get rid of industrial wastewater, one must receive permission from a water services provider.<sup>840</sup> In the same way, no one may typically discard industrial wastes in any way other than how the water services provider has permitted.<sup>841</sup> The Act further makes the disposal of effluent contrary to section 7 of the Water Services Act 108 of 1997 an offence liable to paying a fine or imprisonment or both.<sup>842</sup>

There are also various National Waste Management Strategies put in place through specific legislation and amendments in South Africa to specifically deal with pollution and waste management.<sup>843</sup> These prudential measures waste disposal and treatment, which entails developing regulatory requirements to unveil a classification scheme for facilities used for waste treatment and disposal, such as landfills and incinerators, regulations to create a register of treatment facilities, and regulations for furnace emission standards,<sup>844</sup> rules for putting in place a toxic waste declaration system,<sup>845</sup> rules regulating timelines within the licensing scheme, as well as criteria for licensing, monitoring, and suspension at mining and power plant waste disposal sites.<sup>846</sup>

Second is waste minimization and recycling, which is through the implementation of regulations for licensing and garbage reduction evaluation which would be enforced according to the Environment Conservation Act 73, Section 24.<sup>847</sup>

The last measure is waste accumulation, that is to be imposed through restrictions for the control of toxic waste transportation and regulations to establish harmful waste collection and transfer facilities, which would be instated in accordance with the Environment Conservation Act 73 of 1989, Section 24.<sup>848</sup>

<sup>840</sup>Water Services Act 108 of 1997 Section 7(2):

<sup>841</sup> Ibid

<sup>842</sup>Ibid, Section 82(1)

<sup>843</sup> Ian Sampson Deloitte & Touche, 'Introduction to a Legal Framework to Pollution Management in South Africa,' (WRC Report No TT 149/01 March 2001) p.132

<sup>844</sup> Section 44 of the Atmospheric Pollution Prevention Act 45 of 1965

<sup>845</sup> Section 24 of the Environment Conservation Act 73 of 1989

<sup>846</sup> Section 24 of the Environment Conservation Act 73 of 1989 and the Minerals Act 50 of 1991

<sup>847</sup>Ian Smapson (n 864) p.130

<sup>848</sup> Ibid



### **4.3.2 Industrial effluent Management in Cape Town and in the Industrial Parks in South Africa**

Cape Town was once held as the heart of South Africa's industrial history.<sup>849</sup> Cape Town is a municipality, a seaport, the administrative center of the Cape Province in South Africa, and the country's national capital. The city is located 30 miles (50 km) north of the Cape of Good Hope at the northernmost point of the Cape Peninsula.<sup>850</sup>

Cape Town has a total of 1,209 manufacturing industries which categorically includes the food processing industries, automobile and fuel industries, metal industries, pharmaceutical industries and spraying and coating industries.<sup>851</sup>

### **4.3.3 Waste produced by industries in Cape Town and in the Industrial Parks in South Africa**

Aluminum production is related with the production of a couple of types of waste which include, the red mud that is produced during the production of alumina and the greenhouse gas which include the carbon IV oxide and the per-fluorocarbons produced during the smelting of alumina to produce aluminum.<sup>852</sup> Precisely, the analysis for inputs and outputs for secondary aluminum smelting, for production of aluminum alloy is as follows; inputs are scraps, turnings, alloys, dross, oxide, and energy while the outputs are dust, water and oil and non-metallic residue.<sup>853</sup>

The waste generated by the crude oil and natural gas from the mining and mineral processing include wastewater from coal gasification, phosphoric acid production and from copper processing; there is also production of heavy metal ions with the end-product like calcium sulphate, iron, zinc and lead which comes out with the slug from the furnaces and with wastewater,<sup>854</sup> which can possibly lead to natural destabilization if not properly disposed.

There is also waste that emanate from medical facilities which can be sewerage or wastewater containing urine and radio-nuclides, heavy metals from mercury waste, laboratory solvents and

<sup>849</sup> As was shown in; Peter Lang AG, 'Linkages in South African Economic Development' (2010) pp.11-14.

<sup>850</sup>The history for Cape Town

<sup>851</sup> Cape Town Industries.

<sup>852</sup> The global forum of environment focusing on sustainable materials management, Materials Case Study 2: Aluminium Working Document OECD Environment Directorate, OECD, (25-27<sup>th</sup> October 2010) Mechelen, Belgium. Page 4

<sup>853</sup> Ibid page 38

<sup>854</sup> See in; The United States Environmental Protection Agency, on special waste

other disinfectants, anatomical waste, expired cytotoxic drugs, and battery waste,<sup>855</sup> which is also known for causing environmental degradation and other harmful effects to flora and fauna as will be discussed below.

#### **4.3.4 Effects of the waste produced to flora and fauna**

Untreated discharged wastewater has a lot of side effects to human beings, aquatic lives and to plants in general. In South Africa there is the use of marine outfall relied on to pump out of the Cape Town city sewage which mostly is untreated and causes a lot of microbial and chemical pollution. It is said that the green point outfall pumps almost 40 million liters of untreated wastewater and sewage everyday<sup>856</sup> directly into the Atlantic Ocean resulting to water pollution and environmental degradation.<sup>857</sup>

Due to pump failures, the Camps bay wastewater pumping center sometimes discharges untreated wastewater into the sea, an action that again exposes the residents to ailments and to the danger of environmental degradation.<sup>858</sup> Wastewater discharged or subject to reusing by residents without undergoing tertiary treatment also endangers the well-being of human being and the environment, because some chemical compounds like the per fluorinated compounds and estradiol are not sufficiently removed by primary and secondary wastewater treatment mechanisms.<sup>859</sup>

As earlier on addressed by this research paper on industrial effluent management in Uganda, it is a fact that when wastewater rich in BOD, and COD, is let into natural systems, it makes impossible and difficult for aquatic life to exist and also hampers their normal functioning by exerting pressure for oxygen available.<sup>860</sup> COD causes an increase in osmotic potential of water and adjacent soils thus making it difficult for plant life and organisms living in the water.<sup>861</sup>

<sup>855</sup> Comite International Geneve, 'Medical waste management' (International Committee of the Red Cross, 2011) P.15

<sup>856</sup> See in the Wastewater Treatment in Cape Town website,

<sup>857</sup> Green Point Water stories < [Green Point | Water Stories](#) > accessed 11 June 2022

<sup>858</sup> City of Cape Town isixeeke sasekapa Stad Kaapstad website, reported on 05 Feb 2022 through Report by the City of Cape Town, Media house.

<sup>859</sup> See in, " A study of treated wastewater. 2016 research was conducted in Cape Town to identify developing pollutants of concern in reclaimed potable water and evaluate the extent to which they are removed by these facilities. < [Cape Town Waste Water | Water Stories](#) > accessed 11 June 2022

<sup>860</sup> Consultancy Services for SEA, Study in the masterplan for the Leather Industrial Park proposed at Kinanie- Athi River, Machakos County, (November 2015) pp.118

<sup>861</sup> Ibid

Untreated discharged industrial effluent is associated with destroying the natural habitat for aquatic organisms.<sup>862</sup>

Also, the presence of heavy metal ions in water causes chronic diseases to human being like cancer, gastrointestinal illness, urinary infections and dysfunction and even paralysis,<sup>863</sup> and water-borne disease,<sup>864</sup> to those who will come into contact or use it. This may also cause bio-accumulation of heavy metal ions in animal and plant tissues,<sup>865</sup> as was earlier on discussed in this chapter.

#### **4.3.5 Effluent treatment methods applied by industries in Cape Town and in the Industrial Parks in South Africa**

Cape Town has 13 treatment works.<sup>866</sup> An interconnected system of 385 hydrants and 9300 km of pipeline transports effluent to treatment centers. The biggest sewer pipeline in the city has a maximum diameter of 1.8 meters, and sewer pipes are often larger than water pipes to allow for efficient pumping.<sup>867</sup>

Industrial effluent used to be discharged to special sewer systems since the beginning of 1999 where it would go through a series of biological treatment.<sup>868</sup> However, some directed their wastewater into septic tank systems, used method for domestic waste water treatment in the coastal zone.<sup>869</sup> This is quite different from the recent procedure for wastewater treatment.

Pre-treatment, which essentially focuses on the elimination of all large solids, and primary treatment, which uses the centrifugation process to remove solids as well as fats, lipids, and oils, are the current methods for treating wastewater. Following that, the secondary treatment, which

<sup>862</sup> Kiongo, P. K., Wahome, C. N., Muthama, P. M., Muhonja, J., Ngumba, L., Hassan, F., & Momanyi, E. (2021). Evaluation of Effluent Discharge from Steel Manufacturing Industries on the Proliferating Environmental Degradation in Nairobi Metropolitan in the Republic of Kenya. *Journal of Geoscience and Environment Protection*, 9(9), 198-226.

<sup>863</sup> Kosgey, J., Koech, J., Bunyasi, S., Kipkemoi, B., Muthoka, T., & Nyabaro, O. (2015). Determination of Heavy Metals Pollutants in Sediments along the Banks of Athi River Machakos County, Kenya.

<sup>864</sup> Nadir, S., Tole, M., Dharani, N., & Wafula, G. (2020). Effectiveness of a Wastewater Treatment Plant located at EPZ in reducing Pollutants Discharged into River Athi, Kenya.

<sup>865</sup> Kithiia, S. M. (2012). Water quality degradation trends in Kenya over the last decade. *Water quality monitoring and assessment*, 509. p.522.

<sup>866</sup> Isixedke Sasekapa, 'Water Services and the Cape Town Urban Water Cycle' (August, 2018) p.9

<sup>867</sup> Ibid page 28

<sup>868</sup> A Wright, 'Septic Tank Systems in the South African Coastal Zone'1(999) p.7

<sup>869</sup> Ibid 2.

mostly involves the treatment of activated sludge, includes biofiltration as well as oxidation ponds in rural regions and treatment procedures for disinfection. Prior to releasing the disinfected wastewater into the ecosystem or reusing the treated effluent for agricultural and industrial applications, the wastewater undergoes chlorination, ozonation, and phototherapy.<sup>870</sup>

In the Chem City Eco-Industrial Park (CEIP) there is the use of Abi-Methane sewerage digester which separate liquid and solid and then the liquid is treated while the solid is converted into compost or other useful material.<sup>871</sup>

In the Limpopo Eco-Industrial Park (LEIP) waste treatment is planned to be effective by providing all the tenants of the LEIP with plasma gasification<sup>872</sup> to help them in gasifying the noxious and toxic waste and gas emissions to turn them into less hazardous elements.<sup>873</sup>

#### **4.3.6 Recycling of wastewater by industries in Cape Town and in the Industrial Parks in South Africa**

The other method for effluent management is re-cycling, which involves using of waste products to produce other products. Additionally, it may entail pumping cleaned sewage from wastewater treatment or drainage works through a separate network of pipelines to diverse users for industrial and agricultural uses.<sup>874</sup> Thirteen sewage treatment facilities in Cape Town are meant to generate treated effluent that is acceptable for recycling, and a 230 km network of treated effluent pipes transports this water to consumers.<sup>875</sup>

The problem with using treated wastewater in Cape Town is that it endangers human well-being, due to lack of tertiary treatment system to neutralize chemical compounds such as estradiol and per fluorinated compounds which are insufficiently removed.<sup>876</sup>

<sup>870</sup> See the Wastewater Treatment in Cape Town website <[Cape Town Waste Water | Water Stories](#)> accessed 11 June 2022

<sup>871</sup> Desire Greenberg, 'The greening of industrial property developments in South Africa' (July 2014) P.9 2

<sup>872</sup> Municipal waste can be recycled using plasma gasification, which combines electricity and high temperatures to turn it into goods that can be used instead of being burned. Most often, organic waste is converted into a gas that retains all of its chemicals and energy, while inorganic waste is transformed into slag, an inert form of vitrified glass.

<sup>873</sup> Business Focus, 'LEIP – A Greener Industrial Revolution' (21<sup>st</sup> January, 2020)

<<https://www.businessfocusmagazine.com/2020/01/21/leip-a-greener-industrial-revolution/>> accessed 5 July 2022

<sup>874</sup> Isixedke Sasekapa, p.39

<sup>875</sup> Ibid

<sup>876</sup> See in the publication of 2016, in Cape Town wastewater stories website, on treated wastewater conducted in Cape Town to determine the extent to which developing pollutants of concern are eliminated by water

Also, in the Chem City Eco-Industrial Park (CEIP) the use of Abi-Methane sewerage digester is applied which separates liquid and solid and then the liquid is treated while the solid is converted into compost or other useful material.<sup>877</sup>

In the Limpopo Eco-Industrial Park (LEIP), recycling of waste produced by the industries is promoted by the use of integrated plasma gasification which vaporizes solid waste at about 2000 degree Celsius leaving a verified slag, which is used as a construction material.<sup>878</sup> This spirit of recycling of waste is said to have gained its basis from some industries which used to turn their waste into energy to be used by the same industries.<sup>879</sup>

#### **4.3.7 Reusing of waste products produced by industries in South Africa**

The treated wastewater is subject to use by a variety of consumers for irrigation and for industrial purposes.<sup>880</sup> In the Chem City Eco-Industrial Park (CEIP) gray water is filtered and used within the industrial park, which reduces almost 60% of the portable water consumption in the park.<sup>881</sup> In the LEIP, the slag that is left after vaporizing solid waste at temperatures of 2000 degree Celsius is used as a construction material.<sup>882</sup>

#### **4.3.8 Challenges of industrial effluent management in South Africa**

##### ***Inadequate wastewater treatment and waste disposal mechanisms***

Talking of inadequate waste disposal mechanisms we should as well note the inadequate material recovery facilities and waste buy-back centers in South Africa.<sup>883</sup> To understand this, it is essential to know that Cape Town lacks a secondary drainage system, which results in the release of lingering medical and petroleum contaminants into the city's rivers and ultimately the

reclamation and wastewater treatment facilities. <<http://waterstories.co.za/cape-town-waste-water/>> accessed 15 October 2022

<sup>877</sup> Desire Greenberg, (July 2014)9

<sup>878</sup>See in Business Focus, 'LEIP – A Greener Industrial Revolution' (21<sup>st</sup> January, 2020)

<<https://www.businessfocusmagazine.com/2020/01/21/leip-a-greener-industrial-revolution/>> accessed 5 July 2022

<sup>879</sup> See the Blog by Jonathan Dyble 'Utilising the latest technologies and solutions, Eco-Industrial Solutions and the Limpopo Eco Industrial Park are set to raise the continent's sustainability benchmark' (published by Africa Outlook on 28<sup>th</sup> November, 2018)

<sup>880</sup> Isixedke Sasekapa, p.39

<sup>881</sup> Desire Greenberg, p.9

<sup>882</sup>Business Focus, LEIP – A Greener Industrial Revolution, (21<sup>st</sup> January, 2020)

<<https://www.businessfocusmagazine.com/2020/01/21/leip-a-greener-industrial-revolution/>> accessed 5 July 2022

<sup>883</sup> Polasi T, S. Matinise & S.Oelofse, 'South African municipal waste management systems; Challenges and Solutions,' (The United Nations Environmental Programmes. May 2020) p.7

ocean.<sup>884</sup> This still endangers the aquatic and human life since estradiol and per fluorinated compounds are insufficiently removed.<sup>885</sup>

Marine outfalls are among the methods used to discharge sewerage and other effluent in Cape Town City with Green point and Hout Bay being the most popular for operating sewerage systems.<sup>886</sup> In order to successfully discharge wastewater from the coast, the maritime streams operate from the seashore; the town had to apply for a permit as a national requirement for it to discharge waste into the sea water via Green point and Hout Bay marine outfalls.<sup>887</sup> The Hout Bay sewerage works handles raw sewerage and other effluent which is screened before being discharged into the coastal waters. The question remaining to be whether the effluent being discharged is subject to pre-discharge treatment mechanisms?<sup>888</sup>

The usage of coastal spillways to discharge waste is still inefficient, especially in light of Cape Town's daily pumping into the Atlantic Ocean of about 40 million liters of raw sewage.<sup>889</sup> As such, the sea becomes infected by microorganisms and chemicals, violating the entitlement to an environment that is safe for one's well-being.<sup>890</sup>

A good example is in the study by Petrik L, Green L and their colleagues on effects of marine outfalls.<sup>891</sup> The study showed the results of samples taken from the ocean in parts of the city of Cape Town, as a step towards the proposed idea of producing drinking water through desalination of sea water.<sup>892</sup> The results were that the sea water contained high level of microbial

<sup>884</sup> Ibid

<sup>885</sup> See in, "A study of treated wastewater (2016)" A research was conducted in Cape Town to identify developing pollutants of concern in recycled potable water and evaluate the extent to which they are eliminated by these facilities, < [Cape Town Waste Water | Water Stories](#)>accessed 11 June 2022

<sup>886</sup> Greater Cape Town Civic Alliance website, 'City of Cape Town's sewerage: The report that caused the stink, posted by Webwolly,' (15<sup>th</sup> June, 2015)

<sup>887</sup> Ibid

<sup>888</sup> Ibid

<sup>889</sup>The Wastewater Treatment in Cape Town website< [Cape Town Waste Water | Water Stories](#) >accessed 11 June 2022

<sup>890</sup> See in Green Point Water stories< [Green Point | Water Stories](#) >accessed 11 June 2022

<sup>891</sup>Petrik, L., Green, L., Abegunde, A. P., Zackon, M., Sanusi, C. Y., & Barnes, J. (2018). Corrigendum: Desalination and seawater quality at Green Point, Cape Town: A study on the effects of marine sewage outfalls. *South African Journal of Science*, 114(1-2), 1-1.

<sup>892</sup> Ibid page 1

pollution and that waste discharged through the marine outfalls caused persistent organic and inorganic pollutants which contaminated the seawater.<sup>893</sup>

### ***Pump failures***

Consistent pump failure at Bay marine outfalls was reported to have forced beaches like the Camp Bay, Glen, Maidens cover and Tidal pools to be closed for samples to be taken to determine pollution levels.<sup>894</sup> Also residents and businesses in Camps Bay area were forced not to generate wastewater by reducing the use of washing machines and dishwasher and to only flush their toilets if necessary, if the pumps at the pumping station fail.<sup>895</sup> Due to pump failure sometimes the sewage is discharged directly into the sea especially when there is large volume of sewage, and this is likely to expose the residents to ailments and environmental degradation.<sup>896</sup>

### ***Non-compliance with regulations by industries***

Non-compliance is directly linked to the problem of enforcement of legislation, which in turn brings operational challenges, poor planning and management, which have been addressed in the UNEP. Non-compliance with regulations mostly delves around illegal dumpsites and waste disposal sites.<sup>897</sup>

Regarding non-compliance which include dumping of waste irregularly, Lizzette and his colleagues in their work, cited Lu, 2019 and Lia *et al* 2017, defining irregular dumping as intentional abandonment of waste on un-authorized site instead of dumping waste at an authorized landfill site.<sup>898</sup> In South Africa, most landfills operate without licenses and those with them do not comply with the requirements by the Department of Environmental Affairs<sup>899</sup> currently referred as the Department of Forestry, Fisheries and the Environment (DEFF).<sup>900</sup> For

<sup>893</sup> Ibid page 1-2

<sup>894</sup> Report by the City of Cape Town, Media house reported on 05 February 2022, p. 1

<sup>895</sup> Ibid

<sup>896</sup> Ibid

<sup>897</sup> Ibid page 2

<sup>898</sup> Schenck C J; Nell C M, Grobler L; Blaauw P F, 'Clean cities and towns: Understanding societal behaviour in order to reduce and divert waste going to landfills', (31 March 2022) p.122,

<sup>899</sup> Polasi T., S. Matinise & S.Oelofse, 'South African municipal waste management systems; Challenges and Solutions' (May 2020)p.5

<sup>900</sup> The Department of Environment, Forestry & Fisheries is one of the departments of the South African government. < <https://www.dffe.gov.za/> >accessed 11 September 2022

example the DEFF identified 69 illegal landfills in South Africa, it also in 2018 identified the problem of dumping hazardous waste at the general landfill site.<sup>901</sup>

#### **4.3.9 Remedies for the wrong and how to assure compliance with the regulations by industries in South Africa**

Wastewater must be subjected to proper treatment protocols with the ability to remove both bacterial loads and inorganic compounds, and there should be adequate testing and monitoring of chemical compounds in recovered water.<sup>902</sup>

##### ***The use of Plasma Gasification to minimize waste production***

South Africa has been keen and innovative in waste management strategies, as indicated by the recently launched Limpopo Eco-industrial Park.<sup>903</sup> The major objective is to highlight large and small sectors with waste reduction emission, such as sustainable farming, metals and mineral processing, agri-processing, and many more.<sup>904</sup> According to sources, the Limpopo Eco-Industrial Park (LEIP) would produce virtually no waste products, making it the first eco-industrial estate in the globe and a significant step towards environmental sustainability.<sup>905</sup>

LEIP aims at zero-solid waste and nearly zero gas emission which is to be achieved by integration of plasma gasification into the industrial system.<sup>906</sup> The journey towards zero waste production began with some companies using technology to turn their waste to energy.<sup>907</sup> Instead, the LEIP will evaporate waste products using ionized combustion at a temperature of about 2000 degrees Celsius, producing confirmed slag that will be used as building material.<sup>908</sup>

<sup>901</sup> Polasi T., S. Matinise & S.Oelofse, 'p.5

<sup>902</sup> Petrik, L., Green, L., Abegunde, A. P., Zackon, M., Sanusi, C. Y., & Barnes, J. (2018). Corrigendum: Desalination and seawater quality at Green Point, Cape Town: A study on the effects of marine sewage outfalls. *South African Journal of Science*, 114(1-2), 1-1.

<sup>903</sup> Limpopo Eco-Industrial Park (LEIP) will be the world's first eco-industrial park to practically produce zero solid-waste

<sup>904</sup> Business Focus, 'LEIP – A Greener Industrial Revolution,' (21<sup>st</sup> January, 2020)

<sup>905</sup> Ibid

<sup>906</sup> See the Blog by Jonathan Dyble on 'Utilizing the latest technologies and solutions, Eco-Industrial Solutions and the Limpopo Eco Industrial Park are set to raise the continent's sustainability benchmark' (published by Africa Outlook 28<sup>th</sup> November, 2018

<sup>907</sup> Ibid

<sup>908</sup> Business Focus, LEIP – A Greener Industrial Revolution (21<sup>st</sup> January, 2020)

<<https://www.businessfocusmagazine.com/2020/01/21/leip-a-greener-industrial-revolution/>>accessed 5 July 2022



All LEIP renters will receive ionized hydrolysis, which will decrease all dangerous constituents in obnoxious and poisonous waste gas emissions.<sup>909</sup>

There are commercial parks in South Africa as well, including the Lord View Eco-industrial Park on the northern edge of Johannesburg and the Chem City Eco-industrial Park on the southern edge of Johannesburg.<sup>910</sup>

***Development of on-site recycling and the use of Abi-methane sewerage digester for treatment of wastewater***

The Chem City Eco-industrial Park (CEIP) has industries like Sasol, Safripol, Omnia, Mittal steel etc. and is developed by a large South African integrated and chemical manufacturer.<sup>911</sup> The main goal is promoted environmentally friendly mechanisms of managing waste through recycling of on-site material in construction and development of a civil infrastructure. For example, storm water drainage, sewerage treatment systems, filtration of gray water which reduces almost 60% of portable water consumption and the use of Abi-methane sewerage digester which involves separating liquid and solid then treat the liquid and convert the solid into compost or other useful products.<sup>912</sup>

***Establishing industries with environmentally friendly conditions***

The Lords view Eco-industrial Park is structured as an eco-sensitive industrial and logistics park.<sup>913</sup> Fostering industrial and logistics development while focusing on promoting sustainable environment is the key reason for the establishment of Lords View Eco-industrial Park.<sup>914</sup>

This means that it would include reducing the amount of waste production by either turning some of their waste into energy like some of the industries in LEIP. Also, the use of Abi-methane sewerage digester which involves separating liquid and solid then treat the liquid and convert the solid into compost or other useful products like in Chem City Eco-industrial Park (CEIP), and the use of recycling and reusing of wastewater.<sup>915</sup>

<sup>909</sup> Ibid

<sup>910</sup> Desire Greenberg, 'The greening of industrial property developments in South Africa' (July 2014) p.8-9 <

<sup>911</sup> Ibid page 9

<sup>912</sup> Ibid

<sup>913</sup> Lords View Industrial Park - 3 Poplar Crescent Chloorkop Ext 66 Midrand Gauteng, Property description by agent Raymond Lurie, page 1-2 < <https://curriegrup.co.za/properties/features/pdf/?pid=537>>accessed 6 July 2022.

<sup>914</sup> Ibid

<sup>915</sup> Desire Greenberg, 'p.9

### ***Courts and NEMA***

NEMA is firm on ensuring the seeking of an authorization before any development or expansion, extraction or mining takes place.<sup>916</sup> NEMA has also been firm on ensuring compliance with the requirement for licensing of waste management activities.<sup>917</sup>

Courts in South Africa are vested with a very integral obligation of ensuring and emphasizing on the need for state organs like the municipalities to act in accordance with the Constitution.<sup>918</sup> This extends to the municipalities' obligations to protect the environment. Therefore, courts determine whether a municipality running a waste dumping site has breached the requirement of the waste management license and give orders thereto. An example was by the supreme court of South Africa (Kwazulu-Natal division, Pietermaritzburg) in the *South African Human Rights Commission vs Msunduzi Local Municipality and 8 others*.<sup>919</sup> The matter in this case concerned the new England Road Landfill site in Pietermaritzburg. According to the claims, the Msunduzi municipal did not operate the waste site in a way that did not endanger the health and wellbeing of the residents of Pietermaritzburg and the surrounding area.<sup>920</sup> The court determined that the first defendant had violated the second complainant's modification wastewater treatment permit, which was issued on July 3, 2017, and related to the landfill's administration. It instructed the first respondent to create an action plan outlining the actions he will implement to keep compliance with the provisions of the waste variability permit within a month. It also instructed the first respondent to set periodic deadlines for the progress, and those involved were invited to comment on the plan.<sup>921</sup>

### **4.4 Conclusion**

Based on the analysis given in this paper it clearly shows that South Africa is far much a head of most African countries. Transport and communication, labor, raw materials and good policies are the key factors for industrial development as was observed by Caleb Mireri in his thesis by the

<sup>916</sup> Bowmans Firm, Guide to environmental law in South Africa, 2020. page 10,

<sup>917</sup> Ibid

<sup>918</sup> Merafong City Local Municipality v AngloGold Ashanti Limited [2016] ZACC 35; 2017 (2) BCLR 182 (CC) para 60 & 61.

<sup>919</sup> 17<sup>th</sup> June, 2021

<sup>920</sup> South African Human Rights Commission vs Msunduzi Local Municipality and 8 others (17<sup>th</sup> June 2021) p. 3,

<sup>921</sup> Ibid page 38

title, Industrialization of Athi River Town.<sup>922</sup> The Department of Transport, which is in charge of laws and regulations for railway, refineries, highways, airports, harbors, management of mass transit, and freight transportation, oversees South Africa's highly developed system of transportation and communication through clearly defined regulations.<sup>923</sup> South Africa is also ahead in terms of waste management especially through the eco-industrial parks which have a common goal of promoting sustainable environment and utilization of resources.<sup>924</sup>

However, effluent management is still not a challenge for developing countries like Uganda alone, because even South Africa as per reports has been experiencing problems in managing large volumes of sewage and has been forced to discharge it directly into the ocean especially in cases of pump failure and there are large volumes of wastewater.<sup>925</sup>

South Africa is a good case for lessons Kenya can take in industrial effluent management when it comes to water resource conservation and sustainability in an industrial park. It is clear that there is need to employ the latest or atleast newer technologies to achieve this. As noted from the LEIP design, that each tenant (industry) would be provided with the plasma gasification technology. The import is that as opposed to the Ugandan design and probably Kenyan way currently, the proponents and developers of LEIP would be the ones ensuring that this efficient method of waste and effluent management is provided to the industries. This in essence takes the burden of costs off the industry and would ensure compliance with implementation.

South Africa is already ahead in greening its industrial parks and industries. For instance, the case of the Chem City Eco- Industrial Park which uses the Abi-methane sewerage digester which separates liquid and solid then treat the liquid and convert the solid into compost or other useful products and the use of recycling and reusing of wastewater. This ensures that waste produced is reduced and re-used.

It is not clear how the sludge left after industrial effluent has been treated and discharged from the EPZ waste treatment plant in Mavoko is disposed of. Is it turned into raw materials for other uses? Is it dumped into landfills? Can the same be turned into useful resource as is the case with the Chem City Eco-Industrial Park?

<sup>922</sup>Caleb M.C Mireri , 'Industrialization of Athi River Town', (1992) pp.69-91

<sup>923</sup>South African Government, [www.gov.za](http://www.gov.za), 'Let's grow South Africa together'

<sup>924</sup> Desire Greenberg, (July 2014) pp.8-9

<sup>925</sup> Report by the City of Cape Town, Media house reported on 05 February 2022

The analysis in this paper has precisely shown that the two countries have made a good step in promoting industrial development and in environmental management. However, it should be noted that South Africa is ahead of Uganda both in the level of industrialization and wastewater management through the industrial parks as shown by Desire Greenberg.<sup>926</sup>

Uganda is still facing the problem of lack of enough funds to develop the modern sewer systems and enough wastewater treatment systems like South Africa, where a single city like Cape Town has almost 13 wastewater treatment works.<sup>927</sup> Uganda also largely grapples with use of outdated waste water management systems or inefficient systems even in their latest eco-industrial park KIBP. There is thus need to employ newer and better technologies as industries will continue increasing and thus pressure on natural resources will be even more. Uganda however sought extra funding to be able to improve and modernize the infrastructure in the KIBP project.<sup>928</sup>

Other challenges that are common to the two countries are on the implementation of the existing legal policies, institutional failure, poor planning and management and operational challenges in balancing the competing interests that is the entitlement to a clean environment, the obligation to conserve environment and to encourage country's growth.<sup>929</sup> It seems to be an area that each country will need to continuously work on.

For Kenya, it is clear that it is possible to green our industrial parks or rather achieve an eco-industrial park with zero to minimal waste production. It is all a matter of good planning and having funds availed for the project as well as providing each individual industry (tenant) with the technology or an assembly point for waste collection to enable further processes such as segregation, sorting etc for recycling purposes. Such a move would be different from the current state of affairs as provided in the EMCA and WA, where the industries incur the cost or are left with the responsibility to acquire newer and better technologies. It is evident that such efforts have been a failure in Kenya and Uganda in the KIBP.

<sup>926</sup> Desire Greenberg, pp. 8-9

<sup>927</sup> Isixedke Sasekapa, 'Water Services and the Cape Town Urban Water Cycle' (August, 2018) P.19

<sup>928</sup> Muwanga, David. 2021. Kampala Industrial and Business Park (KIBP) To Create 200,000 Jobs. EABW News.

<sup>929</sup> Polasi T., S. Matinise & S.Oelofse, 'South African municipal waste management systems; Challenges and Solutions,' (The United Nations Environmental Programmes, May 2020) p.5

## **5.0 CHAPTER FIVE: FINDINGS, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Findings of this Study**

The research questions in this study are:

- a) What is the current situation in the governance of industrial effluent discharge and treatment in Mavoko Sub- County?
- b) How adequate is the regulatory framework governing the industrial effluents' treatment and discharge in Mavoko sub-county?
- c) What are the environmental impacts caused by the discharge of industrial effluents in Mavoko sub-county?
- d)What are the gaps and opportunities if any in the governance of industrial effluent in Mavoko subcounty?

This study conducted a conceptual analysis of the sufficiency of the regulation and supervision regarding the conduct and disposal of untreated wastewaters with regards to Mavoko, Machakos County, to answer the aforementioned questions. The objectives of the study were met. Questions (a) and (c) have already been dealt with in Chapter 2. In short, for (a) the situation in Mavoko is wanting –the governance of industrial effluent is poor- and a lot needs to be done by the industries, NEMA, WRA, County government and other stakeholders such as project proponents. For (c), Chapter 2 has elaborated clearly that poor management of industrial effluent has deleterious effect to the environment affecting human health, animal and plant life. For question (b) above, the same was handled in Chapter 3 but has been briefly touched on below; however, our regulatory framework as it is currently is practicable. It is adequate in that it clearly identifies the problem, the measures taken to deal with the same and also puts in place the monitoring and compliance mechanisms. The main issue with non-compliance lies majorly with a negative culture among the players and stakeholders. Question (d) forms the substance of this chapter and the same has been identified and dealt with at length below.

The gaps and challenges that the environment/ water sector faces in the management of industrial waste water in Mavoko, Machakos County, were identified by this study as:

- a) Poor environmental management -industrial waste water governance- that has led to complacency by industries. It is a fact that Athi River hosts several industrial establishments, but it is also worthy to note that the town is also characterized by poor waste management.<sup>930</sup> Wastewater reuse and industrial emissions are the primary causes of environmental deterioration in Mavoko, according to a 2015 study by WRA.<sup>931</sup> Another illustrative example may be found in Juliana Mutua's study on the efficiency of sanitary policy tools in Kenya's Mavoko District of Machakos County.<sup>932</sup> It was discovered that inhabitants' understanding, and conformity levels were very minimal, and that county and national government conduct was also very subpar.<sup>933</sup> This is noted while having in mind that good governance is at the center of sustainable development. This is an indication that may delay the country's vision 2030 agenda and also in attaining the sustainable development goals. Good governance should include the people, that is the public must be made aware of any action the government intends to take especially if such an action will affect the community directly.<sup>934</sup> The different conclusions made in this research suggest that anybody who may be impacted by legislation(s) should be given a fair chance to contribute. All this is geared towards ensuring public awareness on matters affecting them and ensuring accountability by state organs, all levels of governments presented in the constitution article 69(1), in the Rio Declaration<sup>935</sup> and in *National Land commission vs Attorney General &6 others*.<sup>936</sup> This is traceable from the aforesaid fact that public awareness is always tied to public participation which in turn is among the environmental procedural rights. The municipal and provincial governments' efficient operation is what ensures that appropriate procedures are followed and that

<sup>930</sup> John Omung'ala Away, 'Suitability of Athi River water for irrigation within Athi River town and its environs' (2017) p.15

<sup>931</sup> National Water Resources Situation Report for 2015/2016,

<sup>932</sup> Juliana Kamanthe Muia Mutua, Jones F. Agwata & Stephen Anyango (2017) p.14-15

<sup>933</sup> Ibid

<sup>934</sup> The Bench Book on Environment and Land Matters, Judiciary (2019) p.27

<sup>935</sup> (1992) principle 10

<sup>936</sup> (2015) eKLR

operations are monitored to the same standard.<sup>937</sup> Poor environmental management as per this study can result where the County and the National governments neglect their duty to protect the environment. In *Friends of Lake Turkana Trust vs, the Attorney General and 2 others*,<sup>938</sup> as shown in chapter 3, the court held that the State, under Article 69 of the Constitution should safeguard the environment and to make sure there is justifiable utilization of raw materials. This trial also highlighted certain crucial ideas, such as the environmental protection and the concept of environmental sustainability, among others.<sup>939</sup>

- b) Poor enforcement /reaction by NEMA and WRA thus aiding the failure of industries and project proponents to comply with the law. This study has presented precise information on how enforcement is undertaken or is to be enforced following the requirements in the Constitution.<sup>940</sup> However, NEMA which maintains its status for being the lead agency of the State in environmental governance, in some instances has irregularly/unprocedurally issued the EDL and EIA licence and in some gone ahead to issue licences before undertaking proper inspections on compliance with the recommendations given. The case of *Amu Power Company Ltd*<sup>941</sup> as shown in chapter 3 of this study provides a good example for this point. In this case NEMA had recommended some conditions before issuing the EIA licence; apart from the conditions being inadequate, the court also found that NEMA had not considered all the requirements, comments from the public, and if the conditions had been complied with before issuing the licence.<sup>942</sup>
- c) Corrupt NEMA officials: this research has in the previous chapters indicated that corruption is the mother of irregularities in the environmental protection processes like in the EIA(s) and EDL(s) procedure. John Michuki, the former environment minister, was quoted claiming that corruption and inactivity among NEMA workers had damaged the authority's reputation in 2010. This is a good sign of corruption among NEMA

<sup>937</sup> Kariuki Muigua, 'Nurturing Our Environment for Sustainable Development,' (Glenwood Publishers Ltd. 2016) pp. 220-221

<sup>938</sup> (2014) eKLR(Nairobi ELC)

<sup>939</sup> *Friends of Lake Turkana Trust vs the Attorney General and 2 others* (2014) eKLR (Nairobi ELC)

<sup>940</sup> Article 69

<sup>941</sup> Tribunal appeal no. Net 196 of 2016

<sup>942</sup> *Jammal Ahmed Ali & 5 others vs NEMA & another* Tribunal appeal no. NET 196 of 2016

officials.<sup>943</sup> He was further captured directing the authority to clean up its act to restore public confidence in it. On the same note he also talked about some NEMA officials who had been accused of corruption in awarding the EIA licence to investors with rampant claims that they demanded bribes for the service.<sup>944</sup>

- d) Poor or no updated record keeping/data base by NEMA/WRA of industries in Mavoko discharging effluents. Documentation keeping fosters managerial competency and upholds the historical pattern of process advancement and learning.<sup>945</sup> If NEMA would elect to have a more modernized data base, it will be very easy for it to monitor the status of the industries when it comes to compliance, with recommendations given and the impact of the actions on the surroundings. Lack of these modernized records pose the danger of most proponents of various projects escaping the sword of law by providing false information regarding the progress of the industry on matters of the environment or even departing from the mitigation measures presented during the EIA when the industry is in operation.
- e) Failure of industries having waste management plans and submission of the same to NEMA: This study has been very precise on this issue because this is what makes the industries to have the latitude of dumping their effluent without well-defined pre-treatment mechanisms. For example, a report by Kenya tribune showed that Mavoko residents had expressed their fear of water bone diseases out-break due to improper garbage collection and disposal.<sup>946</sup> On the same note, there are industries that were found to dump their waste in River Athi without pre-treatment mechanisms when NEMA toured the river Athi. The waters in the river had turned pink due to high effluent discharges.<sup>947</sup> Another example is on the EIA for London Distillers (K) Limited (LDK)report.<sup>948</sup> It demonstrated the absence of a suitable waste management strategy. Instead, the industry directed its liquid waste to River Athi causing 15000 people to suffer silently, risks of

<sup>943</sup> Nation News 'Michuki puts corrupt Nema staff on notice' (2010) <<https://nation.africa/kenya/news/michuki-puts-corrupt-nema-staff-on-notice--637718> > accessed 17 October 2022

<sup>944</sup> Ibid

<sup>945</sup> Kwamba Dennis, 'Analysis of the records of NEMA intervention to disasters in Nigeria' (2018)p.1

<sup>946</sup> Kenya Tribune < <https://www.kenyatribune.com/mavoko-residents-raise-the-alarm-over-poor-sanitation/> > accessed 17 October 2022

<sup>947</sup> The Standard. 2021. NEMA issues stern warning to factories discharging waste into Athi river.

<sup>948</sup> LDK report compressed (2019) p.6



getting skin cancer and respiratory diseases as well as other negative effects to game animals, fish, water animals and plants were noted to have increased.<sup>949</sup>

- f) Poor town planning: The preceding chapters of this research have shown how poorly planned industrial locations next to residential neighborhoods expose residents to environmental concerns such carbon emissions, dust, and insecticides. The flower fields along the Mombasa highway that were near to rapidly developing residential neighborhoods and exposed residents to the insecticides and other contaminants utilized in the farms are the instance used in this research.<sup>950</sup>
- g) Lack of smooth coordination between NEMA and WRA: this study has under chapter three addressed an issue to do with duplicity in roles and it was specifically directed to NEMA and WRA since they are tasked with similar functions. An example is the licensing of projects that are likely to discharge effluents to water resources, which is an obligation for NEMA under EMCA<sup>951</sup> and an obligation for WRA under the Water Act.<sup>952</sup> This breeds confusion between the two authorities thus interfering with the proper coordination and functioning of the two authorities.
- h) Use of manual system by NEMA: most of the challenges addressed in this study regarding waste management can be attributed to the fact that NEMA has not fully embraced modern technology. This is what makes Kenya to be seen as still grappling with environmental challenges due to the population growth, increased industrialization and urbanization, which puts technology at the center of implementation of the existing laws and policies for waste management.<sup>953</sup>
- i) Use of outdated waste water management technologies/systems: this is among the prime factors leading to natural destabilization because some industries in Mavoko lack the modern pre-treatment mechanisms to treat effluents before discharging them into the

<sup>949</sup>Ibid page 6

<sup>950</sup>Un-Habitat, 'Mavoko Urban Sector Profile' (2006) p.8 < <https://dokumen.tips/documents/kenya-mavoko-urban-profile.html?page=2>.> accessed 12 May 2022

<sup>951</sup> Of 1999, section 75

<sup>952</sup>No.43 of 2016, section 36(c)

<sup>953</sup> Business Daily, 'How NEMA is using technology in pollution war'(2022);<

<https://www.businessdailyafrica.com/bd/data-hub/how-nema-is-using-tech-in-pollution-war-3833758> > accessed 17 October 2022

environment causing environmental degradation.<sup>954</sup> This study has also shown that the treatment facility at the Export Processing Zone (EPZ) is insufficient in reducing phosphates, nitrates and heavy metals during the rainy season, thus qualifying it to be categorized as an outdated mechanism for effluent treatment.<sup>955</sup>

- j) Lenient penalties: this study in Chapter 3 has relied on various cases and sections of the law showing the prescribed penalties for the offence relating to environmental pollution, like that for polluting water resources.<sup>956</sup> However, the penalties which include compensation of the victim of pollution<sup>957</sup> and cost of restoration<sup>958</sup> at times do not correspond with the damage suffered. This is because some of the legislative provisions rob the courts of discretion in penalizing the parties found guilty of environmental pollution by providing for lenient maximum penalties. An example is the requirement that the penalty should not be more than Kshs. 1 million and if it's a prison term not to exceed two years.<sup>959</sup> These provisions force the court to have some leniency in giving the penalties for the numerous offenses concerning to the surroundings created under EMCA and the Water Act of 2016, thus creates some laxity among project proponents in fully implementing the requirements under the law.

## **5.2 Does our legislative framework promote or factor in industrial symbiosis and sustainable development concepts?**

Sustainable growth, according to the United Nations Commission on Environment and Development assessment, is defined as development that satisfies current demands without preventing future societies from satisfying their own. Industrial Symbiosis refers to a system developed by industries where within the system, industries use the waste produced by another, which reduces the consumption of raw material and the cost of waste disposal.<sup>960</sup> It also protects the environment by diverting waste from landfills.

<sup>954</sup>Juma Lillian Adhiambo, 'WasteWater Management: A case of reducing wastewater release into environment in Mathare North, Nairobi County' (2014) p.21

<sup>955</sup>Nadir, Stanley, Mwakio Tole, Najma Dharani, and Godfrey Wafula. "Effectiveness of a Wastewater Treatment Plant located at EPZ in reducing Pollutants Discharged into River Athi, Kenya." (2020). p.262

<sup>956</sup> Water Act no.43 of 2016, section 143(1)(b)

<sup>957</sup>Constitution of Kenya 2010, Article 70(1)

<sup>958</sup>EMCA, part (ix) sections 108-116

<sup>959</sup>Water Act no.43 of 2016, section 147

<sup>960</sup> Nordregon News on Industrial Symbiosis (2016)

Any economic development must be sustainable.<sup>961</sup> Industrial symbiosis converts the negative environmental externalities like waste to positive environmental externalities by bringing about re-using of the by-product which reduces pollution.<sup>962</sup> This makes it the best mechanism for fostering sustainable development.<sup>963</sup> A good example of waste exchange is shown in chapter 2, in Athi River where the community has developed a win-win working relationship between the informal waste recyclers residing in the surrounding community and the zone garment factories. So they could easily obtain the fabric off-cuts for reuse and recovery in the future, the informal e - waste recyclers would clean the clothing manufacturers in this case for free.<sup>964</sup> The garment factory benefits by getting a substantial reduce in the cost for cleaning the factories and for waste management, and through this the factories are able to save an estimate of USD 6000 yearly.<sup>965</sup> The advantage for casual trash refiners is that they receive free clothing textile off-cuts, have them assessed, and resell them to makers of sofa sets and mobs. There is an estimate of 15 tons of cloth fabric off-cuts being recuperate per month, which was going out for Ksh.6 per kg in the year 2016 giving a general income of about USD 900 per month to the informal waste recyclers. Another example is as seen between the oil extraction factories and the animal feed companies which produce seed cake and macadamia kernel as the by-products from primary edible oil processing company and from macadamia seeds oil factory respectively. <sup>966</sup> This prevents garbage from going to dumps and instead puts it to use in the economy and environment, both of which are consistent with the idea of sustainable development. <sup>967</sup> There are provisions for environmental sustainability in the Constitution. The prologue urges administration of farmland that is sustainable and beneficial as well as the care and preservation of the environment for the coming generations. <sup>968</sup> The foundation for sustainable development is provided by this. Additionally, one of the fundamental principles and ideals of management is sustainable development.<sup>969</sup> Furthermore, the Constitution gives the National and Municipal governments

<sup>961</sup> The United Nations Commission on Environment and development report (Our Common Future) 1987

<sup>962</sup> Sigrid Kusch, ScEnSers Independent Expertise, 'Brief for GSDR, Industrial symbiosis: powerful mechanisms for sustainable use of environmental Resources, (Germany 2015)

<sup>963</sup> Ibid

<sup>964</sup> Ibid

<sup>965</sup> Ibid

<sup>966</sup> Ibid

<sup>967</sup> Ibid

<sup>968</sup> Article 60(1) (c)

<sup>969</sup> Article 10

the authority to oversee the environmentally responsible use, administration, and protection of natural resources <sup>970</sup> and to control pollution. <sup>971</sup> . <sup>972</sup> EMCA is also another mechanism for promoting sustainable development by ensuring that every development corresponds to the required environmental standards by ensuring that Environmental Audits and Monitoring is conducted.<sup>973</sup> Also by providing for principles that are in line with that of justifiable growth, like the contaminator remunerates which requires the destroyer of environment to endure the price of recovery and of indemnification.<sup>974</sup> Similar to the precautionary principle, which mandates that steps be taken, intergenerational and intragenerational equity, and public participation for practices that affect the environment.<sup>975</sup>These principles are supposed to guide the courts in making their decisions in cases underlining sustainable development. <sup>976</sup> Concepts such as industrial symbiosis engender sustainable development by the conservation of resources and reduction of waste as well as recycling of the same.

Further, it need be noted that the Sustainable Waste Management Act, which was addressed in chapter 3, considers all the above and particularly seeks to ‘green’ our industrial sector.

Thus, our legal framework does promote industrial symbiosis.

The aforementioned issues and deficiencies serve as evidence in support of the claim that Kenya's water resources are not properly sanitized and managed by the current regulatory framework governing the treatment and discharge of industrial effluent. This is because, the laws and institutions as they are, provide for all that is practicably needed for industrial effluent to be better managed as well as have natural resources conserved. Further, even advanced countries like South Africa still continue to grapple with this issue and that the existing ministerial structure would not provide sufficient solutions to deal with the challenges faced in that regard. Despite courts of law being active and issuing punitive penalties to parties in contravention, industries still continue to flaunt the law. NEMA and other agencies officials have shown laxity in their enforcement role by reacting after the fact instead of being proactive. The findings, gaps

<sup>970</sup> Article 69(1)(a)

<sup>971</sup>Constitution of Kenya 2010, Schedule four, part 2, function 3

<sup>972</sup> Ibid

<sup>973</sup> EMCA, Secs 68-69

<sup>974</sup> EMCA, Sec 3(5)

<sup>975</sup> Ibid

<sup>976</sup> The Bench Book on Environment and Land Matters, The judiciary, (Nairobi-Kenya. 2019)P.21

and challenges indicated above point mostly to a problem with the culture and how players in the system operate and not necessarily to do with the (in)adequacy of the regulatory regime. This is not to say that there are no shortfalls however, because as long as the problem persists, then indeed there still is a deficiency with the regulatory regime, which can always be improved to serve people better.

The objectives set out in this study were also met by the findings. Therefore, to address the challenges and gaps that have been identified, recommendations have been suggested below.

### **5.3 Conclusion**

This research undertook to assess the fairness of the regulatory framework – laws and institutions- governing the treatment and discharge of industrial effluents in Mavoko, Machakos County. The underpinning theoretical frameworks for the study were the sustainable development and the industrial symbiosis concepts.

The study also did a comparative study of Uganda and South Africa so as to check how the two countries fair in this respect and if there are any lessons to be drawn from them.

The two ideas are essential for the preservation of the natural and environmental assets, as already elaborated in chapter one. This study has clearly indicated the interplay of these two concepts in relation to industrial waste water management. The significance of these ideas cannot be overstated given that most industrial processes depend on water and that waterways are either depleting or deteriorating at a faster rate than they are replenishing. Secondly, industries use a number or various natural resources as raw materials for their processes and in turn churn out various waste products which can be turned into useful raw materials for other industries. Industries can as well capitalize on recycling waste materials and water from their effluent instead of dumping all untreated effluent into water resources. These efforts would be crucial in saving and preserving fresh water resources, reducing demand and wastage as well as reducing waste churned out by industries and ensuring that waste discharged is safe to the environment, to avoid water scarcity as was experienced in South Africa<sup>977</sup> as addressed in chapter four.

<sup>977</sup>See in the Joan Igamba's blog on Water Crisis in South Africa(5 July 2022);

The Constitution, has engendered the place of environmental management/governance in Kenya. It recognizes the place of internationally accepted environmental concepts/principles as part of Kenyan law. The Constitution places environmental rights at par with the entitlement to life. The similarity between the two has already been shown. When the entitlement to safe and clean surroundings has been breached or if environmental safety is compromised, then the lives of human beings, animals and plants become endangered. Animals and plants are a source of food, and survival of human beings and animals depend on it. Although Kenya already has legal institutions in existence, the gaps and issues mentioned above show that Kenya does have a long road ahead. Through the establishment of environmental courts which are at par with the high court, Kenya has entrenched the enforcement and compliance of laws pertaining to environmental governance. This is a pat on the shoulder.

As regards the two countries used for comparison, Uganda has still some long way to go with respect to waste management and in particular industrial effluent management. From the case of Uganda, Kenya can draw a number of lessons. For instance, the dangers of poor planning- failure to avail funds and strict adherence to timelines of projects; dangers of poor implementation of set plans. Uganda in a bid to grow its economy and industrialize herself, laid out an ambitious plan for the largest eco-industrial park (KIBP) in Uganda, which unfortunately has not lived up to its objectives. This has resulted to the project dragging over a number of years and poor implementation of the plan, as industries continue to discharge raw effluent into River Namanve and Lake Victoria. Most importantly, we learn that the burden of employing newer and better technologies for (industrial) waste management should not be solely left to the industries or the entities. Rather it should either be collaborative or as part of the infrastructure provided in the industrial park by the developers or proponents.

South Africa has the advantage of economic power and has thus employed newer and better technologies in waste management going forward and this is a great lesson for Kenya. South Africa has also tried to update some current industrial business parks to make them greener in line with the concepts discussed above<sup>978</sup>

<sup>978</sup> South Africa can be said to be leading in innovation when it comes to waste management, South Africa has several eco-industrial parks with well-defined mechanisms for waste management and has recently launched the Limpopo Eco-Industrial Park which aims at using plasma gasification to promote zero waste production. See at; Lords View Industrial Park - 3 Poplar Crescent Chloorkop Ext 66 Midrand Gauteng, Property description by agent

Most crucially, despite being the most industrialized nation in Africa, South Africa still struggles with industrial wastewater management issues, such as pump failures in waste treatment facilities,<sup>979</sup> inadequate recovery facilities and waste buy-back mechanisms,<sup>980</sup> as addressed in chapter 4 of this study. This shows that, this is largely an issue that countries can always improve on by making positive strides. Further, the management of this issue is deliberate in that laws, institutions and policies in place must be in place together with factors such as availing funds for employing newer and better technologies.

The recently enacted law, Sustainable Waste Management Act,<sup>981</sup> has come at a most important time. It aims to implement specific reforms in waste disposal through the creation of a suitable legal and institutional structure for efficient and sustainable waste management, as stated in Chapter 3.<sup>982</sup> Though this piece of law has taken effect, it will become fully operational in two years after the enactment of all subsidiary legislations and regulations under it. It is a great piece of legislation that would help to revolutionize the waste management sector.

Also, Kenya needs to seriously consider having in place an industrial waste water reuse policy. Such a policy would inform guidelines on the best way to go about in this sector for all players. Such a policy would do well for Kenya more so because Kenya seeks to industrialize herself by 2030 as per Vision 2030<sup>983</sup> and the effects would be immense strain on natural resources and fresh water. A policy would consider all factors that the laws already has only that it would provide guidelines where there have been changes or shift in the sector to better guide all the players and stakeholders.

These weaknesses and issues in our institutional and legal framework need to be urgently addressed so that we can better manage our natural and fresh water resources. A further review

Raymond Lurie, page 1-2 ; <<https://curriegrup.co.za/properties/features/pdf/?pid=537>> accessed 17 October 2022.

<sup>979</sup> City of Cape Town isixeeke sasekapa Stad Kaapstad website, reported on 05 Feb 2022 through Report by the City of Cape Town, Media house

<sup>980</sup> Polasi T. ,S. Matinise & S.Oelofse, 'South Africanmunicipal waste management systems; Challenges and Solutions,' (The United Nations Environmental Programmes May 2020)p.7

<sup>981</sup> 2022

<sup>982</sup> See < [https://ecotourismkenya.org/wp-content/uploads/ekdownloads/press\\_releases/KEPSA%20REVIEW%20NATIONAL%20WASTE%20MANAGEMENT%20BILL%202019%20Changes.pdf](https://ecotourismkenya.org/wp-content/uploads/ekdownloads/press_releases/KEPSA%20REVIEW%20NATIONAL%20WASTE%20MANAGEMENT%20BILL%202019%20Changes.pdf) >accessed 17 October 2022

<sup>983</sup> The Kenya Vision 2030 aims to transform Kenya into a newly industrialized country providing a high quality of life to all its citizens by 2030

of our legal and institutional framework needs to be done and this study therefore suggests recommendations on how industrial waste water in Mavoko and Kenya at large can be better governed.

## **5.4 Recommendations**

For there to be effective governance of industrial waste water treatment and discharge in Mavoko and Kenya at large, an evaluation of existing institutional and legislative context affecting the same has to be done. This will ensure that while the said activities are being conducted, the environment as a whole is protected and preserved for all generations.<sup>984</sup> The suggestions are provided below and are grouped into short term, medium term or long term depending on the length of time needed, resources required and level of stakeholders' participation or involvement.

### ***Short term***

#### **5.4.1 Sensitization of industries on industrial waste management:**

this sounds so ordinary or obvious however, it should be an ongoing practice to inculcate the culture in the players. An award system could also be employed to recognize industries doing their part on this front by NEMA. To avoid a situation like that described in Juliana Mutua's scientific report on the efficiency of hygiene initiatives in Mavoko Municipality of Machakos County, Kenya, this will assist eradicate ignorance among people as well as industrial owners,<sup>985</sup> where she and her colleagues found that most of the residents in Mavoko were not aware of the policies and therefore compliance was also very low.<sup>986</sup> NEMA, the County governments and the various industry associations such as Kenya Manufacturer's Association come in handy here.

#### **5.4.2 Sensitization to staff members:**

NEMA and other enforcement agencies, could do well in continual sensitization of its officers against laxity and corruption as the same encourages complacency by industries and project proponents. NEMA should also acquire newer or better or updated methods of monitoring to check with compliance as well as maintaining a database of industries operating within a given area. Records should be updated and submitted within the set timelines. This may require funds availed and a change in the culture of operating or doing things.

<sup>984</sup> See the principle of Inter-generational and Intra-generational Equity, (The Stockholm Declaration) 1972

<sup>985</sup> Juliana Kamanthe Muia Mutua, Jones F. Agwata & Stephen Anyango (2017)

<sup>986</sup> Ibid page 14



## *Medium term*

### **5.4.3 Better coordination between NEMA and WRA:**

The EMCA and the Water Act both provide for licenses to be acquired by project proponents or industries. There should be a system in place of ensuring one license is acquired instead but with the approval of both NEMA and WRA to ensure efficiency of the processes. In such an instance, the agencies collaborate and coordinate on the functions. A multi-agency taskforce should be able to quickly come up with ideas on way forward on this so as to streamline the process.

### **5.4.4 Re-using/ Recycling (can the waste produced by one industry be used by another or presence of industrial symbiosis in Mavoko)**

This part aims at addressing the possibilities of industries in Mavoko to use the waste produced by other industries or by-product exchange, with the cognition of the fact that waste like sewerage is directed to the Pilot Fertilizer Plant or Sanergy Ltd located at Kinanie.<sup>987</sup> The Sanergy ltd recycles sanitary and organic waste to produce insect-based protein and organic fertilizer that's made by thermophilic. The average volume of natural refuse processed daily amount to 30 tones.<sup>988</sup>

It is a fact that some industrial manufacturing systems recycle or reuse the waste produced within the system while others leave it. Companies with ecological systems that constantly allow reuse of energy and waste in closed loops by other processes within the system are only the more evolved industrial ecosystems with integrated industrial systems.<sup>989</sup> Kelvin Khisa in his work at page one and two referred from the work of Mirovitsakaya and Ascher, 2000, Abston, 2008; ENEP, & Anbumozhi *et al.* 2013, to express the principle of garbage exchange that is to be applied at different spatial levels between and within the companies.<sup>990</sup> This concept loosely refers to the act of trading waste or by-product like other commodities.<sup>991</sup>

The UNIDO's (United Nations Industrial Development Organization) fundamental concepts for greening companies, which primarily involve treating solid, liquid, and gaseous waste in basic

<sup>987</sup> Dr. Ayub Macharia, 'Give me organic waste and I will turn it to gold' (2022) p.1<<https://www.mazingirasafi.com/circular-economy-for-organic-waste-in-nairobi/>>accessedn 9 August 2022

<sup>988</sup> Ibid page 2

<sup>989</sup> Kelvin Khisa, 'Development of an industrial ecology model for the Athi River special economic zone: Policy implications for green growth in Kenya' (2016>p.1

<sup>990</sup> Ibid page 1&2

<sup>991</sup> Dr.Salah M. El-Haggar PE, PhD,' in Sustainable Industrial Design and Waste Management'( 2007)Ch3&5

amenities for recycling by other businesses, are in line with the notion of waste and by-product exchange.<sup>992</sup>

This trash exchange concept, together with the growth of eco-industrial parks, lowers the need for the use of waste materials and lowers the quantity of landfills and wastewater discharges.<sup>993</sup> The irregular trash recycling facilities who cleanse the facilities for free so that they may easily obtain the garment companies' fabric off-cuts for reuse or waste collection is a good example of waste exchange.<sup>994</sup> Another important example is between the oil extraction factories and the animal feed companies which produce seed cake and macadamia kernel as the by-products from primary edible oil processing company and from macadamia seeds oil factory respectively.<sup>995</sup>

Insufficient effluent and by-product recovery facilities and lack of public awareness of the environmental and financial advantages of efficient resource use are among the factors impeding the smooth execution of the by-product exchange principle and the development of eco-industrial parks in the Athi River.<sup>996</sup> A good example is where the idea of efficient use of resources was not embraced due to limited awareness and this is a leeway towards a wasteful and un-responsible utilization of the Country's resources.<sup>997</sup>

The industrial players in Mavoko (and Kenya) on their own or through their associations can identify local ways of recycling or reducing waste as seen from the instances noted above. It may not be necessary to wait for industrial symbiosis structures to be fully set up within the industrial hub, rather it is a question of what and how each industry can improve on the issue in the meantime - by recycling, reducing and reusing waste.

### ***Long term***

<sup>992</sup> UNIDO, Global assessment of eco-industrial parks in developing and emerging countries. November 2016, page 3

<sup>993</sup> United Nations Industrial Development Organization, 'Global assessment of eco-industrial parks in developing and emerging countries,' (November 2016) pp.14-16

<sup>994</sup> Khisa, K., Oguge, N., & Obiero, S. A. (2018). Mainstreaming the culture of eco-industrial parks (EIPs) in Kenya for the sustainable realization of the country's vision 2030. *Journal of International Business Research and Marketing*, 3(6), pp. 12-16

<sup>995</sup> Ibid

<sup>996</sup> Ibid 11-12

<sup>997</sup> Ibid

#### **5.4.5 Need to upgrade the exiting industrial business parks and specifically in Mavoko:**

Going by the findings of the industrial effluent management in Mavoko, the national and county governments and relevant stakeholders such as industry associations should take a deliberate move and assess the EPZA as well as the industrial park to ascertain whether the same can be greened in an effort to reduce waste and conserve natural and fresh water resources. This would entail pumping in resources to build infrastructure for collecting, sorting, segregating, classifying waste etc from the various industries and further assess waste produced by the industries and how the waste can be used by other industries for their production processes, instead of all industries relying on the EPZA line and dumping industrial effluent while untreated or discharging the same to the River Athi.

#### **5.4.6 Assessment of town planning:**

It is doubtful how much the county government of Machakos can do so as to change the town planning as it is, given that the structures already in place are capital intensive. However, moving forward efforts should be put in place and funds availed to assess how industries can be placed further away from residential areas. This is achieved by zoning of the areas for better management. The infrastructure for the industrial plans must also be laid down for instance waste collection centers, assortment centers, segregation(s), recycling and treatment etc. Implementation of the requirements set for in the Urban and Cities Act<sup>998</sup> which aspires to put Article 184 of the Constitution into practice, to administer urban regions and towns, to establish the concept of administration and resident engagement,<sup>999</sup> which are integral to environmental governance.

#### **5.4.7 Use of newer and better technologies:**

As has been demonstrated in the case of South Africa, industrial parks are now being established with newer technologies for industrial effluent management being employed. Kenya should employ such efforts for future industrial parks as the market economy in East and Central Africa. The actualization of industrial symbiosis and even the use of plasma gasification which is more of technology and most suitable for waste management. Also through the use of Abi-Methane sewerage digester which separates liquid and solid and then the liquid is treated while the solid is converted into compost or other useful material.<sup>1000</sup> This would greatly lead to resource

<sup>998</sup> (2011)

<sup>999</sup> See a<<https://www.devolutionhub.or.ke/resource/urban-areas-and-cities-act-2011>> accessed 17 October 2022

<sup>1000</sup> Desire Greenberg, 'The greening of industrial property developments in South Africa' (July 2014) p.9

conservation, waste recycling and reduction engendering the green economy concept. This calls for joint efforts among various stakeholders such as both levels of government, industry owners, project proponents and other third parties such as sponsors.

#### **5.4.8 Industrial waste water policy:**

This has already been discussed above. Kenya needs in place such a policy to give guidelines on way forward especially at a time when new waste management technologies emerge and further because Kenya seeks to establish her industrial dominance within the region and Africa by 2030. Populations will keep growing and as the economy expands, much strain will continue to be exerted on natural resources and fresh water resources. There needs to be guideline to help Mavoko residents and Kenyans at large on waste water re-use and management. Formulation of a waste water policy would require the input of the government agencies such as NEMA, WRA, industry players such as associations and the public.

### **5.5 Further research areas recommended**

Noting the limitation of the study being limited time hence resulting in conducting a theoretical examination of the institutional, governmental, and legal structure, more research should be done to identify other key factors that could improve the management of industrial waste water according to the sustainable development and industrial symbiosis concepts. There should also be further research on the factors contributing to poor industrial waste water management culture in Kenya despite there being practicable laws and institutions in place for governing industrial waste water management- treatment and discharge. Research on how to achieve collective wisdom should be done so that processes in which active public involvement is integral, like in the EIA processes can adequately be achieved.

## **6.0 BIBLIOGRAPHY**

### **6.1 Books**

Kakuru K and Ssekyana I, Handbook on Environmental Law in Uganda Volume I, 2nd Edtn, February 2009.

Kaluli J, and Others, 'Towards A National Policy on Wastewater Reuse in Kenya' (2011).

Lumumba P, Mbondenye M, and Kabau T (eds). Devolution in Kenya a Commentary, 2016

Mbote P, Akech M, Okidi C.O, Environmental Governance in Kenya, Implementing the Framework law, 2008

Muigua K, Nurturing Our Environment for Sustainable development (2016)

Muigua K, et al, Natural Resources and Environmental Justice in Kenya (2015)

Spijkers O, 'Intergenerational Equity and the Sustainable Development Goals' (2018)

The Judiciary. Bench Book on Environment and Land Matters. 2019

United Nations Industrial Development Organization, Implementation Handbook for Eco-Industrial Park, 2017.

### **6.2 Online Journals and Journal Articles**

Andrew C Worthington, 'Commercial and Industrial Water Demand Estimation: Theoretical and Methodological Guidelines for Applied Economics Research' 28 22. 'Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan' *at* *NAP.Edu*<<https://www.nap.edu/read/6031/chapter/7>> .

Armah, E. K, Chetty, M, Adedeji, J. A, Kukwa, D, Mutsvene, B, Shabangu, K. P, & Bakare, B. F., 'Emerging Trends in Wastewater Treatment Technologies: The Current Perspective. In I. A.

Moujdin, & J. K. Summers (Eds.), Promising Techniques for Wastewater Treatment and Water Quality Assessment. IntechOpen.' (2020)

Anabwe John, 'Effect of Wastewater from Kampala Industrial and Business Park on Bukasa Swamp Water,' (2019 <<http://makir.mak.ac.ug/handle/10570/7823>>

Tara Hudson, 'The water crisis in uganda: realities and solutions.' (27<sup>th</sup> March, 2021).

Abegunde AP, Zackon M, Sanusi CY, Barnes J. 'Desalination and seawater quality at Green Point, Cape Town: A study on the effects of marine sewage outfalls.' S Afr J Sci. 2017;113(11/12), Art. #a0244

Benenv, 'Compact Wastewater Treatment System' <<https://en.benenv.com/index.php/products/compact-wastewater-treatment-system/item/compact-wastewater-treatment-system-2>> .

Angiro, C., Abila, P.P. & Omara, T. 'Effects of industrial effluents on the quality of water in Namanve stream, Kampala Industrial and Business Park, Uganda.' *BMC Res Notes* 13, 220 (2020)

A Wright, 'Septic Tank Systems in the South African Coastal Zone.'(1999),

Brian Jaoko Odongo, 'Assessing water supply and demand management in industries and commercial enterprises in Arthi River town, Machakos,' (2012)

Boix, M., Montastruc, L., Azzaro-Pantel, C., & Domenech, S. (2015). Optimization methods applied to the design of eco-industrial parks: a literature review. *Journal of Cleaner Production*, 87, 303-317. Bila-Isia Inogwabini, 'Ecology and Sustainable Development,' (February 2019) <[https://www.researchgate.net/publication/332946694\\_Ecology\\_and\\_Sustainable\\_Development](https://www.researchgate.net/publication/332946694_Ecology_and_Sustainable_Development)>

Birguy Lamizana, 'Wastewater Production, Treatment, and Use in Kenya.'

Cary Coglianese, 'Measuring Regulatory Performance: Evaluating the Impact of Regulation and Regulatory Policy,' OECD (2012)

Christopher Angiro, Patric P'Odyek Abila & Timothy Omata, Effects of industrial effluents on the quality of water in Namanve stream, Kampala Industrial and Business Park, Uganda. 2020.

Cytonn Real Estate, 'Athi River investment opportunity,' <<https://www.cytonn.com/uploads/downloads/athi-river-investment-opportunity.pdf>>

Dr. Mahindra Pratap Choudhary et al, 'Environmental Degradation: Causes, Impacts and Mitigation,' (2015)

Dr. Ayub Machari, 'Give me organic waste and I will turn it to gold.' (2022), <<https://www.mazingirasafi.com/circular-economy-for-organic-waste-in-nairobi/>>

Daoliang Li, Shuangyin Liu, 'Water Quality Monitoring and Management,' Elsevier, 2019. Chapter 12.

Development of an industrial ecology model for the Athi River special economic zone: Policy implications for green growth in Kenya, (2016)

Dr.Salah M. El-Haggar PE, 'Sustainable Industrial Design and Waste Management,' (2007

Desire Greenberg, 'The greening of industrial property developments in South Africa,' (July 2014).

Emily Corcoran, 'Sick Water? The Central Role of Wastewater Management in Sustainable Development: A Rapid Response Assessment' (UNEP/Earthprint 2010).

Environmental Protection Agency, 'How waste treatment works, Office of water,' (May 1998).

Florence Korir Chebet, 'Discharge of Industrial Effluents in Kenya: Adequacy and Implementation of the Laws' <<https://su-plus.strathmore.edu/handle/11071/6189>>

Flory Kilingo, Zulu Bernard, Chen Hong –bin, ‘The Analysis of Wastewater Treatment System Efficiencies in Kenya: A Review Paper. (International Journal of Scientific and Research Publications),’ (May 2021), Volume 11, Issue 5

Gathu Joseph Ndung’u, ‘Analyzing the Impact of Devolution on Economic Development Potentialities in Kenya,’ (2014) Vol.26, 11.

Godswill A. Chinaza, ‘Industrial Waste Management: Brief Survey and Advice to Cottage, Small and Medium Scale Industries in Uganda,’ International Journal of Advanced Academic Research | Sciences, Technology & Engineering | ISSN: 2488-9849 (January 2017) Vol. 3, Issue 1

Hawa Nabuuma, ‘Examining Environmental Impact Assessment as a mode of implementing the precautionary principle in Uganda.’ (2019)

Hezron Mogaka and others, ‘Climate Variability and Water Resources Degradation in Kenya: Improving Water Resources Development and Management, ’(The World Bank 2005).

Helen H. Lou et al, ‘A game theory-based approach for energy analysis of industrial ecosystem under uncertainty’ (2004)

Hannah Wang'ombe, ‘Kenya’s future lies in industrialization,’ (2015 — updated on July 04, 2020). Paragraph 10 and 11,

Journal of Resources Development and Management ISSN 2422-8397 ‘An International Peer-reviewed Journal’ Vol.32, (2017). <[www.iiste.org](http://www.iiste.org)>

John Omung’ala Aywa , ‘Suitability of Athi River water for irrigation within athi river town and its environs,’ (2017). <[http://repository.seku.ac.ke/bitstream/handle/123456789/3550/Aywa\\_Suitability%20of%20Athi%20River%20water%20for%20irrigation%20within%20Athi%20River%20town%20and%20its%20environs.pdf?sequence=1&isAllowed=y](http://repository.seku.ac.ke/bitstream/handle/123456789/3550/Aywa_Suitability%20of%20Athi%20River%20water%20for%20irrigation%20within%20Athi%20River%20town%20and%20its%20environs.pdf?sequence=1&isAllowed=y)>



Juliana Mutua & Jones Agwata, 'Challenges and Interventions in Sanitation Management Approaches in Mavoko Municipality.' (2017) Vol.32  
<<file:///C:/Users/High%20Court%20civil/Downloads/37192-40250-1-PB.pdf>>

Juma Lillian Adhiambo. 'WasteWater Management: A case of reducing wastewater release into environment in Mathare North, Nairobi County.' (2014).

Johnston K, Jesang K, Stephen Bi, Kipkemoi B, Titus M. Muthoka, Obed M. Nyabaro , 'Determination of Heavy Metals Pollutants in Sediments along the Banks of Athi River Machakos County, Kenya. International Journal of Science and Technology,' (2015) Volume 5

Kariuki Eddy Gatuiri, 'Global Strategy Implementation Challenges of Kenya's Multilateral Environmental Agreements with the United Nations Environment Programme in Nairobi Kenya'. (2008)

'Kenya: 2030 WRG and EPA Support Nairobi in the Management of Industrial Wastewater' (*Afrik 21*, 9 November 2019) .

Kenya Population and Housing Census: (2019) Volume 1

Khisa, K., Oguge, N. & Obiero, S.A, Mainstreaming the Culture of Eco-Industrial Parks (EIPs) in Kenya for the Sustainable Realization of the Country's Vision 2030, (2018). '*Journal of International Business Research and Marketing*, 3(6)'

Mathews, 'Industrial Discharge in Nairobi, an analysis of regulatory environment,' (2019),  
<<https://ir-lirary.ku.ac.ke>>

'Mogden Formula and Trade Effluent Charges; 'Water Treatment Services,' (2019).

Melissa Denchak, 'Water Pollution: Everything You Need to Know' (NRDC).

Vision 2030 < <https://vision2030.go.ke/about-vision-2030/>>

Ministry of Industrialization and Enterprise Development, 'Kenya's Industrial Transformation Programme.' (2016)

Michael Lockwood et al, 'Managing Protected Areas: A Global Guide' Earthscan, London Sterling, VA (2009).

Morrison Rwakakamba (Uganda's Investments Authority Chairman), 'Uganda's industrial journey, achievements and progress.' (2022)

Muigua K. et al, 'Streamlining Water Governance in Kenya' 2017

Nyasani Mbaka and Benson Osuma, 'Muunganowa Wanavijiji. (Focus on Athi River).' (2012).  
<<https://www.muungano.net/browseblogs/2012/04/24/focus-on-athi-river.>>

Nicodemus Othieno, 'Prospecting the waste generation among industries in Kampala industrial and business park.' (2017).

Oliver Schwank, 'Linkages in South African Economic Development. Industrialization without Diversification. South African Industrial Development.' Peter Lang AG, (2010).

Olivier Thomas, Marie-Florence Thomas, 'Chapter 10 - Industrial Wastewater, Editor(s): Olivier Thomas, Christopher Burgess, UV-Visible 'Spectrophotometry of Water and Wastewater (Second Edition), Elsevier, (2017), Pages 317-348, ISBN 9780444638977,  
<[>](https://www.sciencedirect.com/science/article/pii/B978044463897700010X)

Philippa England, 'Problems and Prospects for the Implementation of Sustainable Development in Developing Countries: A Critique of the Brundtland Report,' 2 Griffith L. Rev. 147, 160' (1993).

Polasi T. S. Matinise & S.Oelofse, 'South African municipal waste management systems; Challenges and Solutions,' (2020), page 5.

Patrick K. Kiongo, Catherine Njoki Wahome, Peter Muli Muthama, Jeniffer Muhonja, Linah Ngumba, Feisal Hassan & Evans Momanyi, 'Evaluation of Effluent Discharge from Steel Manufacturing Industries on the Proliferating Environmental Degradation in Nairobi

Metropolitan in the Republic of Kenya. *Journal of Geoscience and Environment Protection*, (September 2021) Vol. 9,

Phil.bettary, 'Wastewater treatment plants: Design and operation aspects.' (November, 2017).  
<[Presentation Template \(sia-toolbox.net\)](#)>

Petrik L, Green L, Abegunde AP, Zackon M, Sanusi CY, Barnes J, 'Desalination and seawater quality at Green Point, Cape Town: A study on the effects of marine sewage outfalls.' *S Afr J Sci.* 2017;113(11/12), Art. #a0244, 10 pages. <http://dx.doi.org/10.17159/sajs.2017/a0244>.

P Walakira J Okot-Okumu, 'Impact of Industrial Effluents on Water Quality of Streams in Nakawa-Ntinda, Uganda.' (2011) Vol. 15. No. 2

Philip Karugaba, 'A win for the environment.' (2015),

Richard Helmer and others (eds), 'Water Pollution Control: A Guide to the Use of Water Quality Management Principles' (1st. ed, E & FN Spon 1997).

'Sustainability Concepts: 'Industrial Ecology'

Shadrack Mulei Kithiia, 'Water Quality Degradation Trends in Kenya over the Last Decade,' (2010) < [file:///C:/Users/pc/Downloads/Water\\_Quality\\_Degradation\\_Trends\\_in\\_Keny.pdf](file:///C:/Users/pc/Downloads/Water_Quality_Degradation_Trends_in_Keny.pdf)>

Stanley Nadir, N.Dharan, Mwakio p. Tole, Godfrey Wafula, 'Effectiveness of a Environmental Impact Assessment study report for the proposed expansion of Mombasa cement Athi River cement grinding plant,' (2017)

Springer J *et al*, 'The Natural Resource Governance Framework; Improving Governance for Equitable and Effective Conservation,'

Tatjana Schellenberg and others, 'Wastewater Discharge Standards in the Evolving Context of Urban Sustainability–The Case of India' (2020) 8 *Frontiers in Environmental Science*.

Timothy Omara, Nicodemus Othieno, Jimmy Obonge, Stephen Ssebulime, Moureen Kansiiime, ‘Characterization and Prognostication of Wastes Generated by Industries in Kampala Industrial and Business Park—Namanve.’ Academic publisher, (April 2019)Vol.6 No.4,

United Nations Industrial Development Organization, ‘Global assessment of eco-industrial parks in developing and emerging countries.’ November 2016,

UN-Habitat, ‘Mavoko Urban Sector Profile 2006.’ <[Kenya: Mavoko Urban Profile | UN-Habitat \(unhabitat.org\)](https://unhabitat.org/kenya-mavoko-urban-profile)>

‘UNIDO | Department of Economic and Social Affairs’.

Valentined Cheruyot, ‘Integration of corporate environmental responsibility in cement production process (a case of Athi River cement mining in Kilifi County),’ University of Nairobi, 2021.

Wang, Hongtao & Wang, Tao & Zhang, Bingru & Fengting, Li & Toure, Brahim & Omosa, Isaiah & Chiramba, Thomas & Abdel Monem, Mohamed & Pradhan, Mahesh, ‘Water and Wastewater Treatment in Africa; Current Practices and Challenges.’ (2014).

Water Quality and Waste Water Act.

Wakiaga Phyllis, ‘Why Kenya needs an Industrial Water Policy’ <<https://kam.co.ke/kenya-needs-industrial-water-policy>>

‘Wastewater Management; 'An UN-Water Analytical Brief’ (*UN-Water*).

Wafula, Godfrey & Tole, Mwakio & Dharani, N. & Nadir, Stanley.’ Effectiveness of a Wastewater Treatment Plant located at EPZ in reducing Pollutants Discharged into River Athi, Kenya.’(2020)

‘Waste Water Management – 'The Role of Industries’ (*Land Portal*, 22 March 2017) <<https://landportal.org/node/43609>>

Walkira Paul & Okot-Okum, “Impact of Industrial Effluents on Water Quality of Streams in Nakawa-Ntinda, Uganda, J. ‘ppl. Sci. Environ. Manage.’ (June, 2011) Vol. 15 (2) 289 – 296. page 1.

### 6.3 Thesis

Caleb Mc. Mireri, *‘Industrialization of Athi River Town’* (Submitted in partial fulfillment of the requirements of the degree of Masters of Arts in Planning in the Department of Urban and Regional Planning, Faculty of Architecture, Design and Development of the University of Nairobi 1992)

Christopher D. Hugo, *‘Investigating integrated catchment management using a simple water quantity and quality model: A case study of the Crocodile River Catchment, South Africa’* (A thesis submitted in fulfillment of the requirements for the degree of Master of Science at Rhodes University 2014)

Mukwaya John Christopher, *‘Municipal Wastewater Management in Kawempe Division, Kampala Capital City Authority’* (Bachelor’s thesis April 2013 Environmental Engineering)

### 6.4 Website and News Articles

Bernardine Mutanu, ‘Mavoko shoe factory managers arrested over pollution of Athi River.’

City of Cape Town isixeko sasekapa Stad Kaapstad website,

Erastus Mulwa, ‘Governor Mutua shuts down Walker over Pollution.’(2019).  
<<https://www.standardmedia.co.ke/eastern/article/2001323399/governor-mutua-shuts-down-walker-industries-over-pollution>>

‘Factories closed; owners arrested for polluting environment.’

Factories-closed-owners-arrested-for-polluting-environment&catid=10&Itemid=454> paragraph 4 and 7. ‘National Environment Management Authority (NEMA) - Water Quality Regulations’

Greater Cape Town Civic Alliance website. City of Cape Town's sewerage: The report that caused the stink, posted by Webwolly, on 15<sup>th</sup> June, 2015.

Green Point Water stories. <[Green Point | Water Stories](#)>

How NEMA is using technology in pollution war, 2022, <<https://www.businessdailyafrica.com/bd/data-hub/how-nema-is-using-tech-in-pollution-war-3833758>>

Industries in Mavoko dumping waste in Athi River to be closed, <<https://www.kenyanews.go.ke/tag/factories-in-mavoko-dumping-waste-in-athi-river-to-be-closed/>>

Industry (Athi River) history. <<https://placeandsee.com/wiki/athi-river?spmchkbj=spmprvbj6uoz6fEeoyEWlrfgUTwjzTmjAi.>>

Jonathan Dyble, 'Utilizing the latest technologies and solutions,' Africa Outlook on 28<sup>th</sup> November, 2018.

Joan Igamba's blog on Water Crisis in South Africa, 5<sup>th</sup> July 2022

KNA, 'Athi River residents raise alarm over uncollected garbage bins,' 7<sup>th</sup> November 2020 <[kenyanews.go.ke/tag/mavoko-sub-county/](https://www.kenyanews.go.ke/tag/mavoko-sub-county/)>

Kwamba Dennis, 'Analysis of the records of NEMA intervention to disasters in Nigeria, 2018.'

Kenya Tribune, <<https://www.kenyatribune.com/mavoko-residents-raise-the-alarm-over-poor-sanitation/>>

Michuki puts corrupt Nema staff on notice <<https://nation.africa/kenya/news/michuki-puts-corrupt-nema-staff-on-notice--637718>>

Mavoko municipality <<https://machakosgovernment.co.ke/mavoko-municipality/>>

Report by the City of Cape Town, Media house reported on 05 Feb 2022

South African Government; Let's grow South Africa together. <<http://www.gov.za>>

UNESCO, 'International Bureau of Education; The concept of governance.'

Victor Nzuma, 'NEMA issues stern warning to factories discharging waste into Athi River, 2021'

Water Crisis in South Africa, 5<sup>th</sup> July 2022.

## 6.5 Reports

Antje Heyer, Leonie Kappauf. SFD report. 2018.

Environmental Impact Assessment report of m/s kalki chemical industries for manufacturing of organic chemicals expansion project. 2018  
<<http://www.environmentclearance.nic.in/DownloadPfdFile.aspx?FileName=neZNSz4ZyL8qxQkFAWIJc2BI3951wUoMktXVktCZJrs37tzaLkpnW3cYR9LBF2MJUd3RWeUGFhp89VWYibr3QA==&FilePath=93ZZBm8LWEXfg+HAIQix2fE2t8z/pgnoBhDIYdZCxzVPEh4a7F53Cae7tleKGoXIDiA7chYePNgRJpehWx3dLsaLae8RS5VxBvVdCAnIMg=>>>

Economic Report on Africa, 'Industrializing Through Trade,' United Nations Economic Commission for Africa, 2015.  
<[file:///C:/Users/High%20Court%20civil/Downloads/era2015\\_eng\\_fin%20\(1\).pdf](file:///C:/Users/High%20Court%20civil/Downloads/era2015_eng_fin%20(1).pdf)>

EIA-1635 Grain Bulk Athi River Terminal (SR-1598)-mini pdf. September 2019

<<https://www.nema.go.ke>> Docs > EIA\_1630-1639PDF >

Environmental Impact Assessment study report for the proposed Lancet village on Plot No. Mavoko Town Block 2/19052 at Katani, Mavoko sub county, Machakos county.

Ian Sampson Deloitte & Touche, 'Introduction to a Legal Framework to Pollution Management in South Africa,' WRC Report No TT 149/01 March 2001

LDK Report-compressed, 2019, Pdf

‘The United Nations World Water Development Report, 2017: Wastewater: The Untapped Resource - UNESCO Digital Library’

National Water Resources Situation Report for FY2015/2016,

NEMA; Kenya State of the Environment Report 2019-2021 <  
[https://www.nema.go.ke/images/Docs/EIA\\_1840-1849/Kenya%20State%20of%20Environment%20Report%202019-2021%20final-min.pdf](https://www.nema.go.ke/images/Docs/EIA_1840-1849/Kenya%20State%20of%20Environment%20Report%202019-2021%20final-min.pdf)>

Philip Manyi Omenge, ‘Environmental Impact Assessment Study report for the proposed Expansion of Mombasa Cement Athi River Cement Grinding Plant. 2017’ <  
[https://www.nema.go.ke/images/Docs/EIA\\_1400-1409/EIA\\_1408--Athi-River-Cement-Report.pdf](https://www.nema.go.ke/images/Docs/EIA_1400-1409/EIA_1408--Athi-River-Cement-Report.pdf). >

Water for Industry | United Nations Educational, Scientific and Cultural Organization’ <  
<http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/facts-and-figures/all-facts-wwdr3/fact-8-water-for-industry/>>

‘Water and Sustainable Development: Opportunities for the Chemical Sciences: A Workshop Report to the Chemical Sciences Roundtable’ at NAP.Edu<  
<https://www.nap.edu/read/10994/chapter/11>>

WRMA Performance Report 5, a report to the public from the Water Resources Management Authority for the period 2014/2015. Published by Water Resources Management Authority on October, 2016 <  
[https://wra.go.ke/wp-content/uploads/2019/05/WRMA\\_Performance\\_Report\\_5.pdf](https://wra.go.ke/wp-content/uploads/2019/05/WRMA_Performance_Report_5.pdf)>

## **6.6 Management Plans**

Kenya National Sanitation and hygiene policy 2016 - 2030.

MAWASCO. (2016). Strategic Plan for 2015-2020. Mavoko Water and Sewerage Company



Machakos county approved-final County Integrated Development Plan (2018-2022) <<https://www.nta.or.ke/wp-content/uploads/2020/06/Machakos-County-Integrated-Development-Plan-2018-2022-2.pdf>>

Machakos District Environmental Action Plan ( Machakos DEAP 2009-2013) <<https://www.nema.go.ke/images/Docs/Awarness%20Materials/NEAPS/machakos.pdf>>

Machakos County Integrated Development Plan II (2018-2022) <<https://www.nta.or.ke/wp-content/uploads/2020/06/Machakos-County-Integrated-Development-Plan-2018-2022-2.pdf>>

National Water Master Plan 2030 <<https://wasreb.go.ke/national-water-master-plan-2030/>>

National Environment Action Plan Framework 2009-2013.

The National Development Plan (NDP)2030,<<https://www.gov.za/issues/national-development-plan-2030>>

United Nations Environment Programme. Industry & Environment Office, UNEP, United Nations Environment Programme, Industry and Environment Office (IEO), 1990, University of Minnesota. Digitized on 5<sup>th</sup> April 2017. <[https://books.google.co.ke/books/about/Environmental\\_Auditing.html?id=bbF9QgAACAAJ&redir\\_esc=y](https://books.google.co.ke/books/about/Environmental_Auditing.html?id=bbF9QgAACAAJ&redir_esc=y)>

United Nations Environment Programme, Freshwater, <<http://www.unep.org/Themes/Freshwater/About/index.asp>>

Water Resources Management Strategy 2006-2007