



University of Nairobi

**CENTRE FOR ADVANCED STUDIES IN ENVIRONMENTAL
LAW AND POLICY**

**ANALYSIS OF BARRIERS TO THE ENFORCEMENT OF HAZARDOUS WASTE
REGULATIONS IN THE LEATHER INDUSTRY: A CASE STUDY OF THIKA
INDUSTRIAL AREA, KIAMBU COUNTY, KENYA.**

**A Thesis submitted in partial fulfillment for the requirements for the degree of Masters of
Arts in Environmental Law in University of Nairobi.**

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DECLARATION

This research thesis is my unique effort and has not been presented for any examination in any other institution.

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DEDICATION

I dedicate this work to my loving parents; Dr. Kamau Wango and Dr. Jennifer Wambugu and my son; Ethan Wango Wambugu.

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Contents

CHAPTER ONE	15
1.0 BACKGROUND OF THE STUDY.....	15
1.1 STATEMENT OF THE PROBLEM	26
1.2 RESEARCH QUESTIONS.....	28
1.3 RESEARCH OBJECTIVES.....	28
1.4 SCOPE OF THE STUDY.....	29
1.5 JUSTIFICATION AND SIGNIFICANCE OF THE STUDY	29
CHAPTER TWO	31
LITERATURE REVIEW.....	31
2.1 Introduction.....	31
2.2 Meaning and scope of Hazardous Waste.....	31
2.3 Environmental Bearings of Leather Industry Effluents.....	33
2.3.1 Effect on Surface Water.....	33
2.3.2 Effect on Terrestrial.....	34
2.3.3 Effect on Ground Water	34
2.3.4 Effect on Human Health	34
2.4 State of the Leather Industry in Kenya.....	35
2.5 Roles of National Governments and Counties in Natural Resource Management in Kenya.....	37
2.6 Kenyan Policy and Regulation on Hazardous Waste Management.....	40
2.6.1 The Constitution of Kenya 2010.....	40
2.6.2 National Environmental policy 2014.....	40
2.6.3 Environment Management and Co-ordination Act, 2019.....	41
2.6.4 The Health Act 2019 (Amended).....	41
2.6.5 Draft Toxics and Hazardous Materials Management Regulations 2019.....	42
2.7 The Role of Environmental Standards in the Governance on Chemical and Hazardous Waste Disposal.....	43
2.7.1 Water Quality Standard and Conditions for Discharging Effluents.....	43
2.7.2 Enforcement of the Water Ambient or In- Stream and Effluent Discharge Standards.....	44
2.8 The role of Air Quality standards	45
2.9 Current Legislation on Tannery Effluent Management in Kenya.....	47
2.10 THEORETICAL FRAMEWORK.....	49
2.10.1 Ecological Modernization Theory.....	49

2.11 CONCEPTUAL FRAMEWORK.....	51
2.12 Chapter Summary	52
CHAPTER THREE	53
RESEARCH METHODOLOGY	53
3.0 Introduction	53
3.1 Research Design	53
3.2 Sampling	53
3.3 Sample Size	53
3.4 Location of the Study	55
3.5 Target Population.	57
3.6 Research Instruments.	57
3.6.1 Data Collection Technique	58
3.6.1.1 The Primary data.....	58
3.6.1.2 The Secondary data.....	58
3.8 Data Analysis.....	58
CHAPTER FOUR	59
ANALYSIS TO THE STUDY.....	59
4.0 RESULTS AND FINDINGS.....	59
Table 1. Social Economic Status of Residents Gachagi and Mwanawikio Informal Settlements in Thika.	59
Table 2. Impact of Effluent Discharge on Gachagi and Mwanawikio Informal Settlements in Thika.	61
Table 3. List of Regulatory Institutions and Stakeholders Respondents in Tannery Waste Management.....	65
Table 4: Role of Regulatory Institutions in Tannery Waste Management	69
4.1 Barriers to the Enforcement of Hazardous Waste Regulation in the Leather Industries in Thika, Kiambu County.....	72
Table 5. Barriers to Effective Enforcement of Hazardous Waste Regulations in the Leather Industries in Thika, Kiambu County.....	72
Table 6: Results for Tannery Effluent Discharge Samples from river Chania.....	76
TABLE 7: Results for Chromium Compounds in Tannery Effluent from the Leather Industry Treatment Discharge point.....	78
CHAPTER FIVE	79
5.0 FINDINGS, RECOMMENDATIONS AND CONCLUSSIONS	79
5.1 Summary of Findings.....	79

5.2 Conclusions 79

5.3 Recommendations 80

5.4 Recommendation for Further Research 81

5.5: APENDIX 1 87

LIST OF ABBREVIATIONS/ACRONYMS

C.R.C	Compliance Risk Concepts.
DDT	Dichlorodiphenyltrichloroethane.
DHHS	Department of Health and Human Services.
EIA	Environmental Impact Assessment.
EMCA	Environmental Management and Co-ordination Act.
EPA	Environmental Protection Agency.
FAQ	Frequently asked Questions.
GDP	Gross Domestic Product.
ISOCARP	International Society of City and Regional Planners.
KEBS	Kenya Bureau of Standards.
KMA	Kenya Manufacturers Association.
MEA	Multilateral Environmental Agreements.
NEMA	National Environmental Management Authority.
OAU	Organization of African Unity.
POP	Persistent Organic Pollutants.
PPB	Part per Billion.
PPM	Parts Per Million.
SAR	Sodium Absorption Ratio.
SEA	Strategic Environment Assessment.
SERC	Standard and Enforcement Review Committee.
THIWASCO	Thika Water and Sewage Company.
UNEP	United Nations Environmental Programme.

LIST OF INTERNATIONAL CITED CASES

Agricultural Excess & Suplus Inc. Co. v. A.D.B Tank & Pump Co; 878 F.SUPP.1091, 1096 (N.D. III.1995).

Gobcikovo Nagymaros 1997 I.CJ.7, reprinted in 37 I.L.M 162 (1998).

Indian Council for Enviro Legal Action v Union of India (1996) 2JT 196: (1996 AIRSCW 1069).

LIST OF LOCAL CITED CASES

K.M & 9 others v Attorney General & 7 Others Petition No. 1 of (2016).

Benson Ambuti Atega & 2 Others v Kibos Sugar and Allied Industries Limited & 4 Others
Petition No. 8 of (2018).

Peter K. Waweru (2006) eKLR

LIST OF TABLES

Table 1: Social economic status of residents of Gacagi and Mwanawikio informal settlements in Thika.

Table 2: Impact of leather industry limited effluent discharge in Gachagi and Mwanawikio informal settlements in Thika.

Table 3: List of Regulatory Institutions and Stakeholders Respondents in Tannery Waste Management

Table 4: Role of Regulatory Institutions in Tannery Waste Management

Table 5: Barriers to Effective Enforcement of Hazardous Waste Regulations

Table 6: Results for Tannery Effluent Discharge Samples from river Chania

Table 7: Results for Chromium Compounds in Tannery Effluent from the leather industry treatment discharge point

LIST OF LEGISLATION INSTRUMENTS

1. Environmental Management and Coordination Act (1999) revised edition L.N 31 of 2019.
2. Environmental Management and Coordination Act (1999), (waste management regulation) 2006.
3. Hides, skin and leather Act no. 17 of 2006.
4. The Constitution of Kenya (2010).
5. Water Act no. 43 of 2016.
6. Health Act (Amended) No.5 of 2019.
7. Water Quality Regulations (2006)
8. Draft Toxic and Hazardous Chemicals and Material Management Regulation (2019).
9. Kiambu County Government, Water and Sanitation Act No.2A of 2015.

LIST OF MAPS:

Map 1: Leather Industries of Kenya, Thika

Map 2: Gachagi and Mwanawikio Area, Thika

ABSTRACT

This study examined barriers to the enforcement of hazardous waste regulations in tannery effluent discharge in Thika industrial area, Kiambu County. The study sought to examine; i) efficacy of regulation in tannery effluent discharge in Thika industrial area ii) barriers hindering effective enforcement of regulations on tannery effluent discharge in Thika industrial area and, iii) pollution levels of tanneries in Thika industrial area. Purposive and snow-balling sampling targeted 67 household from Gachagi and Mwanawikio informal settlements in close proximity to the tanneries as well as officers from lead agencies at the County and National levels. Samples from tannery effluents were subjected to; Atomic Absorption Spectrophotometry for heavy metals and UV Spectroscopy for chromium compounds. Quantitative data from interviews and questionnaires was analyzed using SPPSS software. Findings of the study revealed high amounts of heavy metals and Chromium compounds from the tannery effluent discharge into river Chania posing a great health risk for the residents of nearby settlements. The lead agencies tasked with carrying out inspections and monitoring effluent discharge from tanneries lacked modern laboratory technology while enforcement officers lacked proficient knowledge on waste management. Barriers identified by the study to effective enforcement and monitoring of tannery waste management included; impunity and corruption of industrialists, inadequate treatment facilities for tannery waste, and inferior knowledge in tannery waste management and overlapping laws on hazardous waste management. Findings revealed that the current legal frameworks on tannery waste management solely focuses on; licensing, storage, transport, handling and release of toxic wastes but fail to address how monitoring of tannery activities should be conducted. The study recommends; Adoption of technological environmental innovations to achieve a superior environmental performance in view of ensuring that there is sustainable production and consumption, establishment of a coordinated information system between lead agencies at the County and National governments, setting up of modern testing laboratory technology at the County level, revision of EMCA penalties for stiffer penalties and continuous training of enforcement officers.

CHAPTER ONE

1.0 BACKGROUND OF THE STUDY.

The leather trade is one of the dominating industries in many countries in the world as it generates toxic compounds such as ammonia, nitrates, sulphates, chromium salts as well as heavy metals.¹ Tanneries use chemicals that are used in cleaning and processing hides as well as preserving the hides which again allows the production of leather to be commenced without reducing the quality of the leather.

Tanning is one of many industries that produce by far the greatest amount of hazardous waste.² According to Wang, he postulates that about ten to fifteen per cent of the effluent produced from tanning is dangerous and accumulates at a rate of two to five per cent each year.³

Braunig adds that the major concerns with tanneries have generally been odors and effluences. It is approximated that thirty to forty percent of industrial effluent is produced globally every year through dispensation of hides and skins.⁴ Leather trade consumes an oversized quantity of water and also discharges enormous quantity of effluent in water resources. Tanneries pollute the wastewater which generally holds carbon-based and mineral matter with greater levels of lethal contaminants containing sulfides and deposits of chromium compounds.⁵

¹ Tamichelvan, P., Dhinakaran, M (2012) 'Anaerobic Digestion Treatment of Tannery Wastewater.' International Journal of Engineering Research and Applications (IJERA) Vol.2, issue 3, may-june 2012, pp. 932-936.

² Hill, Marqueta. K., *Understanding Environment Pollution*, Cambridge University Press, (2010), p.10.

³ Lawrence K. Wang. & Donald B. Aulenbach, (2006). *Implementation of Industrial Ecology for Industrial Hazardous Waste Management*. In: Lawrence K. Wang, L.K., Hung, Y., Lo, H.H., & Yapijakis, C., (Eds), (2009). *Waste Treatment in the Metal Manufacturing, Forming, Coating, and Finishing Industries*. New York: CRC Press, pp. 1-13.

⁴ Warren A. Braunig; *Reflexive law solutions for factory farm pollution*, (2005). N.Y.U.L Rev., Vol. 80, pp.1505-1548.

⁵ Tamara Bechtold; Eduard Burtscher E. & Hung Yung-Tse. 2006. *Treatment of Textile Wastes*. In: Lawrence K. Wang, Yung-Tse Hung, Howard H. Lo & Constantine Yapijakis (eds), 2009. *Waste Treatment in the Process Industries*. New York: CRC Press, pp.363-398.

According to Chakraborty, pitiable treating methods and usage of crude standard hide processing further intensify the effluence problem. Unselective release of effluents into the water masses or farmlands causes adulteration of surface and ground water.⁶

Furthermore, Chakraborty points out that tannery effluent consists of large amounts of contaminants as a result of the high content of colored compounds such as sodium chloride, sulfates as well as carbon based and mineral substances.⁷

More-so, according to a previous study done by Azon and Mahamud, they connote that hide treating procedure is generally a damp process as it guzzles a substantial amount of water and produces about ninety percent of the discharge as water.⁸ Global appraisal indicates that discharged tannery effluent comprises three hundred to four hundred million tons of pollutants discharged into water bodies annually.⁹

Since Industrial revolution to the present, the generation of hazardous waste has increased.¹⁰ Thus, if these effluents are not treated and discharged properly, then a domino effect will be felt adversely in the environment.¹¹

Be that as it may, even in present tanning forms, it is for all intents and purposes hard to recuperate every one of the contaminants produced. Furthermore, as belay points out, during the tanning procedure, around one ton of cover up typically includes the arrival of around 20 to 80 cubic meters of waste water with chromium amount sums at 250mg/l and sulfide fixations at coarsely 500mg/l.¹²

By 1990, there was as yet no empirical evidence linking health issues to tannery effluent. As indicated by Marqueta, in 1981, the International Agency for Research and Cancer (IARC) found

⁶ Paromita Chakraborty; *Environmental Standard and Trade- Evidence from Indian Textile & Leather Industry*, (2011) Ph. D Thesis, Graduate Institute, and Geneva.

⁷ Paromita Chakraborty; *Environmental Standard and Trade- Evidence from Indian Textile & Leather Industry*, (2011) Ph. D Thesis, Graduate Institute, and Geneva.

⁸ M. R. Azom, Kashif Mahamud; *Environmental Impact Assessment of Tanneries: A Case Study of Hazaribag in Bangladesh*. *Global Journal of Environmental Science and Development*, (2012) Vol. 3, No. 2, 3, 4.

⁹ Alebel Abebe Belay; *'Impacts of Chromium from Tannery Effluent and Evaluation of Alternative Treatment Options.'* (2010). *Journal of Environmental Protection*, 4-5.

¹⁰ Alebel Abebe Belay; *'Impacts of Chromium from Tannery Effluent and Evaluation of Alternative Treatment Options.'* (2010). *Journal of Environmental Protection*, 4-5.

¹¹ Dima W. Nazer, R. M.-S. (2006). Reducing the environmental impact of the unhairing/liming process in the leather tanning industry. *Journal of Cleaner Production* 14 (2006) , 1

Alebel Abebe Belay; *'Impacts of Chromium from Tannery Effluent and Evaluation of Alternative Treatment Options.'* (2010).¹² *Journal of Environmental Protection*, 4-5.

no association between the tanning technique and nasal disease in tanning manufacturing plant staff. However, case reports and studies started revealing a connection between nasal disease as well as bladder and testicular malignant growths to the colorants used in tannery procedures¹³

Furthermore, Belay adds that by mid-1990 other types of cancer related to lungs and pancreas had been closely related to tanning processes which consequently led to researchers uncovering another connection between lung cancer and chromium compound.¹⁴

According to the Eco World forum which was held in 2013, the chromium six compound was termed by the WHO, EPA and DHHS as a human carcinogen. However, some of the developed countries such as Germany went ahead and banned the use of toxic compounds and salts in leather goods processing thereby preventing pollution of about 3Parts Per Million (PPM) back in 2010.¹⁵

More-so, Bechtold and Wang connotes that in Sweden, the leather industry uses both great variety and amount of compounds during the processing of animal skin into fine leather.¹⁶ However, Sweden has adopted safer methods of leather production so as to minimize the health risks.¹⁷ Furthermore, Burtscher observes that in Sweden, majority of the tannery industries have employed environmental management methods and have an effective way of regulating all processes in the tannery.¹⁸

According to Basel convention, Article 2(1), it goes on to define, wastes as; “substances *or objects which are disposed of or intended to be disposed of or are required to be disposed of by*

¹³ Tamara Bechtold; Eduard Burtscher E. & Hung Yung-Tse. (2006). *Treatment of Textile Wastes*. In: Lawrence K. Wang, Yung-Tse Hung, Howard H. Lo & Constantine Yapijakis (eds), 2009. *Waste Treatment in the Process Industries*. New York: CRC Press, pp.363-398.

¹⁴ Alebel Abebe Belay; ‘*Impacts of Chromium from Tannery Effluent and Evaluation of Alternative Treatment Options*.’ (2010). *Journal of Environmental Protection*, 4-5.

¹⁵ <http://www.theshoesnobblog.com/2013/06/leather-quality-how-it-varies.html> accessed on 29th October 2018.

¹⁶ Eco world (2013).Consumer issues. Retrieved April 29, 2013, from http://www.ecoworld.org.uk/eco_topics/waste/consumer-issues.asp.

¹⁷ Tamara Bechtold; Eduard Burtscher E. & Hung Yung-Tse. 2006. *Treatment of Textile Wastes*. In: Lawrence K. Wang, Yung-Tse Hung, Howard H. Lo & Constantine Yapijakis (eds), 2009. *Waste Treatment in the Process Industries*. New York: CRC Press, pp.363-398.

¹⁸ <http://www.theshoesnobblog.com/2013/06/leather-quality-how-it-varies.html> accessed on 29th October 2018.

*the provision of national law.*¹⁹ More-so, the convention further defines what hazardous wastes as;

“Waste that belongs to any category contained in Annex I of the Convention (i.e.: medical waste, waste from wood preserving chemicals, waste from inks, dyes, pigments, and paints, residues from industrial waste disposal, etc.), unless they do not possess any of the characteristics contained in Annex III (i.e.: explosive, flammable, unstable, poisonous, etc.).”

From the foregoing, industrial waste production and disposal management are among the issues that need to be seriously considered and dealt with.²⁰The Resource Conservation and Recovery Act of 1976 of the United States of America define hazardous waste as *“waste with properties that make it potentially dangerous or harmful to human health or the environment.”*²¹ Furthermore, Wang and Aulenbach deposit that hazardous waste is mostly produced from industrial manufacturing process which may be released in solid, liquid or gaseous form.²²

According to Wang,²³ industry is the direct user of water resources as well as the main sources of water pollution. Overall, some 5 to 20 percent of total water usage worldwide goes to industry. More-so, close up to 70 percent of untreated wastes in developing countries are discharged by industries into waters resulting to contamination of water supplies.²⁴

Concerns about sustainable development and environmentally sound policies and laws have been growing considerably in the Kenya in the last decades. Article 42 of the Constitution of Kenya stipulates that; *“every Kenyan has right to a clean and healthy environment.”*²⁵ It further states

¹⁹ Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and their Disposal (Adopted on 22nd March 1989, entered into force on 1992), Art 2(1)

²⁰ Paul T. Williams. *Waste treatment and disposal*. (2005) (2nd Ed.). West Sussex: John Wiley & Sons.

²¹ < <https://www.epa.gov/hw/learn-basics> > accessed on 25th September 2018.

²² Lawrence K.Wang. & Donald B. Aulenbach, (2006). *Implementation of Industrial Ecology for Industrial Hazardous Waste Management*. In: Lawrence K. Wang, L.K., Hung, Y., Lo, H.H., & Yapijakis, C., (Eds), (2009). *Waste Treatment in the Metal Manufacturing, Forming, Coating, and Finishing Industries*. New York: CRC Press, pp. 5-18.

²³ Lawrence K.Wang. & Donald B. Aulenbach, (2006). *Implementation of Industrial Ecology for Industrial Hazardous Waste Management*. In: Lawrence K. Wang, L.K., Hung, Y., Lo, H.H., & Yapijakis, C., (Eds), (2009). *Waste Treatment in the Metal Manufacturing, Forming, Coating, and Finishing Industries*. New York: CRC Press, pp. 9-11.

²⁴ Tamara Bechtold; Eduard Burtscher E. & Hung Yung-Tse. 2006. *Treatment of Textile Wastes*. In: Lawrence K. Wang, Yung-Tse Hung, Howard H. Lo & Constantine Yapijakis (eds), 2009. *Waste Treatment in the Process Industries*. New York: CRC Press, pp.363-398.

²⁵ The Constitution of Kenya (2010), Article 42.

that “every citizen has a responsibility to ensure that they protect, conserve and enhance the quality of the environment.”

Article 42 basically provides for the protection and conservation of the environment for the benefit of the future generations. Article 69 on the other hand obligates the state to ensure that the environment is clean and healthy and should take all necessary measures to ensure Article 42 is upheld and adhered to. Thus the state should take both legislative and administrative measures to prohibit any activities that would compromise the quality of the environment. This makes Article 42 a mandatory right other than a statutory right.²⁶

Article 69(2), obligates all individuals to get together with the state organs and different people to guard and preserve the setting and guarantee ecologically property development and utilization of natural resources.²⁷ In the application of environmental rights, Article 70(1) states that an individual might look for redress in an exceedingly court of law where their right to enjoyment of clean environment is violated, desecrated or vulnerable.²⁸

Article 70(1) provides the right to seek redress upon the right of an individual being infringed in their enjoyment of a clean and healthy environment and also scraps the previous rationale of the aspect of locus standi which barred an individual to approach the court without proof of direct injury from the claimed harm on the environment.²⁹ Article 70(3) provides that an individual doesn't need to proof that they suffered injury or loss so as to seek redress from the court as a result of the harm.³⁰

Article 21(2) allows the state to set up standards that will enable sustainable production and consumption by also focusing on social-economic rights that consider right to affordable sanitation, right to health, right against hunger and right to clean and safe water which can only be achieved if the environment is conserved and protected so as not to infringe on the individual's human rights which are paramount for survival.³¹

²⁶ The Constitution of Kenya (2010), Article 42, 69.

²⁷ The Constitution of Kenya (2010), Article 69(2).

²⁸ The Constitution of Kenya (2010), Article 70(1).

²⁹ The Constitution of Kenya (2010), Article 70(1).

³⁰ The Constitution of Kenya (2010), Article 70(3).

³¹ The Constitution of Kenya (2010), Article 21(2).

Procedural rights advocates for accountability and pellucidity through policies and standards that are meant to ensure that manufacturers take into considerations the rights of the minority groups by ensuring that their production activities are safe and do not cause adverse risk to the marginalized communities. Therefore, there's area for responsibility if the government doesn't shield its right to a clean and healthy atmosphere. In reference to the case of *Benson Ambuti Adegga & two others v Kibos Sugar and Allied Industries restricted & four others*³², the fourth Respondent issued the first Respondent with a license while not the first Respondent closing An EIA study and declaring a story contrary to Section 58 (2) of the EMCA 1999 Act. The failure to conduct the study and submit the report was meant to hide material data and not reveal the character of the activities and therefore the impact on the atmosphere. within the case, the first and third Respondent had been polluting the atmosphere by discharging raw effluent into River Nyamasaria and stream Lielango that was established by the County Government of port, Department of Water, atmosphere, Irrigations and Natural Resources which among the raw effluent being discharged from the plant by the first and third respondents into the rivers was vinesse, a black liquid polluting the atmosphere.

Justice Kibunja in the case, stated that the petitioners established their title against the respondents and declared that the suit is proper as warranted by Article 42 and 43 of the Kenyan Constitution, had been broken by the actions and omissions of the answerers. Justice Kibunja conjointly noted that the provision of the license for the primary respondent by the fourth respondent is unconstitutional, misappropriated and contravenes sections 58, 59,60,61,62 and 63 of EMCA and rules seventeen, 18, 22, 23, twenty four and twenty five of the Environmental Impact Assessment and Testing rules, 2003.

In conclusion, Justice Kibunja issued a permanent injunction restraining first Respondent and third Respondents from operating until they carried out an EIA study and submit reports in accordance with the law and furthermore issued an order of environmental restoration on the first and third Respondents on the harm caused in Kibos space, Miwani Central Location, Kisumu County.

³² Petition No.8 of (2018).

In the case of *K.M & nine Others v lawyer General & seven Others*³³, the petitioners' claim against the respondent was that the eighth Respondent chartered a neighboring plot to the seventh Respondent that found out a lead acid battery utilization industrial plant that activity created waste matter that seeped into the village inflicting the realm residents numerous sicknesses and ailments as a right away consequence of illness with over twenty deaths attributed thereto.

In the call of the case, Justice Omollo declared that; the petition was in smart order before the court because it rolled regarding the violations of the petitioners towards a recent and healthy atmosphere as provided for in Article 42; the rights to life espoused in Article 26; Right to the very best possible normal of aid and sanitation as secured by Article forty three of the Constitution. Article seventy of the Constitution provides that where an individual alleges that his right to clean and healthy environment has been infringed, the individual could seek redress from the court in the same matter. Justice Omollo went on to make reference in the case of *Kibos Distillers restricted & four Others v. Benson Ambuti Adegga & three others*.³⁴ (2020) where it emphasizes that jurisdiction is not inferred by lack of knowledge of the parties.

Justice Omollo further stated that on the issue of liability and compensation, it was indeed no doubt that the petitioners' suffered individually through inhalation/absorption of pollutants from the 7th Respondents and that no treatment was furnished to the petitioners due to the natural processes of the manufactory. Justice Omollo also made reference to the case of *Indian Council for Enviro Legal Action v Union of India (1996)*, where it was submitted; "*The polluter pays principle as understood by this court means that the absolute liability for damage to the environment extends not only to pay the victims of pollution but also the price of reconstructing the environmental degradation. The recommendation of the damaged environment is part of the sustainable development process and as such, the polluter is responsible for paying the cost for the person who is suffering as well as the cost of reversing the damaged ecology.*"

Similarly, in *Waweru v. Republic (2006)*³⁵, owner claimants were suspect of selling untreated sewerage into a public water supply in violation of the general public Health Act. The Court in agreement with the candidates, however more mentioned the implications of the applicants'

³³ *Petition No. 1 of (2016)*.

³⁴ *Petition No.8 of (2018)*.

³⁵ *Peter K. Waweru v Republic (2006)*.

actions for property development and environmental management. The Court dominated that the constitutional right to life is enshrined in Article 71 of Kenya's Constitution however includes the provision for a clean and healthy atmosphere.

In conclusion, Justice Omollo granted order of petitioners' compensation for general damages as a consequence of harm to their health, the environment and for the loss of life; Kshs 1, 3 billion was awarded for the deprivation of life and Kshs 700 million for land/environmental cleanup.

Article 2(5) and (6) of the Constitution of Kenya provides the acceptance of the principles of law as a part of the universal rules of Kenyan law, a decent example being Principle fifteen of the Rio; *“In order to safeguard the atmosphere, the preventative principle shall be wide used by states in keeping with their capabilities wherever there square measure threats of significant or irreversible injury, lack of full scientific certainty shall not be used as a cause for suspending price effective steps to stop environmental degradation.”*

The precaution principle needs that early action is taken before harm really happens to cut back, to limit or management activities that area unit doubtless to cause or risk hurt to the atmosphere through acceptable political, body and legal measures. ”³⁶

In *Gobcikovo Nagymaros case*³⁷, the ICJ deliberated on the issue of environmental accountability that; “mindful that within the space of environmental protection, vigilance and hindrance are needed on account of the usually irreversible character of injury to the surroundings and of the restrictions inherent within the terribly mechanisms of compensation of this sort of injury.”

According to the 2008 Guidelines for Drinking Water and Effluent Quality Monitoring, wastewater is defined as “household and industrial return water”. In addition, the Environmental Management and Co-ordination (Water Quality) Regulations³⁸ offer procedures as well as principles designed for the releasing of toxic contaminant compounds into water bodies such as lakes, rivers, streams as well as underground wells. Section 108 of the Waters Act also prohibits commercial facilities from discharging commercial effluents without the licensee's consent. In addition, section 36 of the Water Act provides for permits to deposit pollutants into any source of

³⁶ Bergen Ministerial Declaration (1970).

³⁷ 1997I.C.J.7, reprinted in 37I.L.M 162(1998).

³⁸ Environmental Coordination and Management Act (1999), Water Quality Regulations (2006).

water, and also pursuant to section 77 of the Water Act, provides that the county government establishes water service providers that are responsible for monitoring water quality standards. However, despite there being national regulations on industrial waste management to which the Kiambu County government is obliged to enforce, it has failed in its mandate to address the issue of waste treatment before disposal of the effluent into water sources.

The Hides, Skin and Leather Trade Act³⁹ provides for licensing as well as quality and standard regulations of the leather production during the tanning process, but fails to address the issue of waste treatment and waste disposal during the leather production.

The new revised EMCA under Section 72, 93(1)⁴⁰ and 141(f)⁴¹ prohibits release of contaminant compounds or matters into any water. Similarly Section 93(3) and 142 (1), (2) provides for punishment of offenders as well as the offender bearing the cost of cleaning the hazardous substance in the environment. Again Section 142 provides for penalties and offences in relation to offences on discharging hazardous chemicals into any aquatic environment.⁴²

All this effluent discharge regulations on industrial waste mainly focus on licensing, storing, transport, handling and dumping of harmful waste but fails to address the issue of how the monitoring of these industrial activities is to be carried out as well as waste treatment of the hazardous waste before discharge. The importance of monitoring bodies is to ensure that these industries do not discharge effluents into the environment which are below the required quantity and standard as stipulated by the regulations. Important to note, is that the responsibility of monitoring is not only solely on government agencies but on the industrialist as well so as to ensure that the effluent being discharged is in harmony with the provisions of the guidelines.

More-so in identifying the gap in this issue of tannery effluent discharge, it is evident that most of the bodies which are defined under EMCA such as NEMA, KEBS and County Government (Ministry of Environmental Affairs) essential for implementation and enforcement have failed to enforce monitoring and inspection of tannery activities thus allowing these industries to continue discharging exceeded levels of effluents into the water bodies and disregarding the concept of

³⁹ Hides, Skin and Leather Trade Act No. 17 of 2006.

⁴⁰ Environmental Coordination and Management Act No. 18 of 2018 Amended L.N 31 of 2019, Section 93(1).

⁴¹ Environmental Coordination and Management Act No. 18 of 2018 Amended L.N 31 of 2019, Section 141(f).

⁴² Environmental Coordination and Management Act No. 18 of 2018, Amended L.N 31 of 2019 Section 92.

waste treatment. Thus making it difficult to establish excellent standards and regulate violation in regards to industrial waste.

According to Chowdhury and Mostafa, Kenya is confronted with legal actions of sustainable management of its tannery industry. With limited regulation of tannery trade, Kenya has evidenced an increased rate of leather production which has resulted to serious environmental adulteration more-so discharging of effluence into the environment.⁴³

According to Kazungu, due to the sensitization of the vision 2030 as well as the big four agenda which are all proponents of the Kenya government, there has been a tremendous increase of industries among them leather industries resulting to increased leather production.⁴⁴ However, the aspect of sustainable development has not been fully realized thus the need to regulate tannery activities to ensure proper discharge of toxic effluence compounds into the environment.

Kazungu further notes lack of effective enforcement on monitoring bodies on environmental standards and criteria control which render the implementation of regulations ineffective.⁴⁵ However, EMCA addresses issues of release of toxic effluents as well as compounds into water sources. The Waste Management Regulations of 2006⁴⁶ defines industrial waste as; “*waste arising from processing and manufacturing industries or trade undertaking and can take the form of liquid, non-liquid, solid and gaseous substances.*” Furthermore the same regulation goes ahead and defines waste management as; “*the activities, administrative and operational, that are used in handling, packaging, treatment, conditioning, reducing, recycling, reusing, storage and disposal of waste.*”

The big-four agenda proposed by President Uhuru’s administration focuses on four main issues; manufacturing, universal healthcare, affordable housing and food security so as to push for better economic growth of the country. In comparison with vision 2030, the big-four agenda does not consider the issue of waste management as a goal to ensure a safe environment. In the big-four agenda, President Uhuru focuses on establishing more industries to improve production thus

⁴³ Nazer W Dima, Al-Saed M. Rashid, Siebel A. Maarten; *Reducing the environmental impact of the unhairing process in the leather tanning industry.* Journal of Cleaner Production 14 (2006), 1.

⁴⁴ Raphael Konde Kazungu; *improving governance for sustainable waste management in Nairobi.* (2010) 46th ISOCARP Congress.

⁴⁵ Paromita Chakraborty; *Environmental Standard and Trade- Evidence from Indian Textile & Leather Industry,* (2011) Ph. D Thesis, Graduate Institute, and Geneva.

⁴⁶ Environmental Management and Coordination Act of 1999: Waste Management Regulation (2006).

resulting in high job creation to enable the people meet their basic needs. However, the increase of industries so as to meet these demands will only lead to environmental destruction if not properly managed.⁴⁷

Thika is well known industrious town apart from Nairobi, Mombasa, Kisumu, Nakuru and Eldoret. More-so it is home to various famous industries in the country and is the capital of Kiambu town. Its rate of population growth is estimated to be 171,430 as per the 2017 census.⁴⁸

Thika has several tannery industries that deal with leather products and services. The Industry generates much effluent into river Chania and river Athi. In addition, toxic fumes are emitted during production of leather.⁴⁹ Nearly all processes of the leather production have environmental implications due to use of various chemicals like sodium chloride, sulphide and chromium salts used to preserve and clean animal skins.⁵⁰ Therefore pollution of Chania River is a reality.

⁴⁷< https://www.the-star.co.ke/news/2018/04/18/big-four-agenda-mid-income-economy_c1744790> accessed on 11/9/2018.

⁴⁸ Digital Topographical Mapping and Preparation of Integrated Strategic Urban Development Plan for Cluster III Towns; (November 2015), County Government of Kiambu, p2-11.

⁴⁹Cecilia Kariuki Wangu: *Factors affecting strong waste administration in Urban Centers* (2015): A contextual analysis of Thika Sub-County Kiambu County Kenya.

⁵⁰Cecilia Kariuki Wangu: *Factors affecting strong waste administration in Urban Centers* (2015): A contextual analysis of Thika Sub-County Kiambu County Kenya.

1.1 STATEMENT OF THE PROBLEM

Tannery industries in Thika, Kiambu County use improper mechanisms and discharge toxic effluent into water sources, with approximately 20,000 cubic meters of hazardous waste being discharged into Chania River as well as underground water sources. The operations of tanneries in Thika, Kiambu County has resulted to immense pollution in River Chania which has also resulted in health problems for human population and aquatic life as well as destruction of farmlands due to the toxic effluent contrary to the Third Schedule of Water Quality Regulations (2006), Article 26, 42 and 43 of the Kenyan Constitution, Section 93(1) and 141(f) of EMCA, Section 45(1) of Kiambu County Government Water and Sanitation Act and Section 36 of the Water Act.⁵¹

In respect to Annex four of the Kenyan Constitution which outlines the functions of the national and county governments in respect of the management and protection of the natural resources in the counties which is geared to establishing a sustainable and developed system of protecting water sources in particular.⁵²

The goal of county assemblies is also to play a part in national resource management and policy development, among other matters. Nevertheless, the constitutional division remains the

⁵¹ Cecilia Kariuki Wangu: *Factors affecting strong waste administration in Urban Centers* (2015): A contextual analysis of Thika Sub-County Kiambu County Kenya.

⁵² Final Report of the Task force on Devolved Government, Vol I (Office of the Deputy Prime Minister and Ministry of Local Government, (Government Printer, Nairobi 2011).

responsibility of national governments and counties to ensure use and management of natural resources.⁵³

At present, Kiambu County has no policy or regulations to ensure standardized control and non-compliance with respect to the management of industrial tannery waste, with only one draft policy in place but not implemented. According to the former Minister of Environment from Kiambu County, no industrial waste management policies or regulations have been implemented. This is primarily due to the lack of the ability of the Kiambu County Government to enact comprehensive environmental protection legislation.

The study sought to establish the efficacy of the National and County regulations on tannery waste management and environmental preservation in Thika industrial area as the two major tanneries operate in full ignorance and disregard of the law resulting to dire effects on health of residents and deterioration of the Chania River and underground water resources within Gacagi and Mwanawikio informal settlements which are in close proximity to the tanneries. An analysis of the impediments to the effective enforcement of the County Level Tannery Effluent Discharge Regulations is required to address the problem of Chania River pollution in informal establishments in Gacagi and Mwanawikio.

⁵³ Chitere, P., Chweya, L., Masya, J., Tostensen, A. and Waiganjo, K., 'Kenya Constitutional Document: A Comparative Analysis, CMI Reports, 2006. Available at <http://www.cmi.no/publications/file/2367-Kenya-constitutional-documents.pdf> (Accessed on 5/11/2020).

1.2 RESEARCH QUESTIONS.

MAIN QUESTION

This study seeks to determine the barriers that hinder effective enforcement of regulations on tannery effluent discharge in Thika industrial area, Kiambu County.

SPECIFIC QUESTIONS

1. What is the efficacy of regulations on tannery effluent discharge in Thika industrial area, Kiambu County?
2. What are the reasons behind lack of effective enforcement of monitoring systems on tannery effluent discharge in Thika industrial area, Kiambu County?
3. What are the pollution levels in wastewater in tanneries in Thika industrial area, Kiambu County?

1.3 RESEARCH OBJECTIVES.

GENERAL OBJECTIVE

The study will establish the barriers affecting the effective implementation and enforcement of tannery effluent discharge management in Thika industrial area, Kiambu County.

SPECIFIC OBJECTIVE

1. To examine the efficacy of regulations on tannery effluent discharge in Thika industrial area, Kiambu County.
2. To examine the reasons behind lack of effective enforcement of monitoring systems in tannery effluent discharge in Thika industrial area, Kiambu County.
3. To examine the pollution levels in wastewater in tanneries in Thika industrial area, Kiambu County.

1.4 SCOPE OF THE STUDY.

The study basically covered the tannery effluent discharge in two major areas along Chania River namely; Gachagi and Mwanawikio informal settlements which have a population of about 5500 and occupy 81.10 square kilometers in size area. Mwanawikio village straddles between Chania River that marks the boundary between Kiambu and Muranga Counties. In this study only the population residing on the Kiambu County side of the river was included in the study.

The study focused on the performance of National and County government institutions namely; Thika Waste and Sewage Company (THIWASCO), National Environmental Management Authority (NEMA), Water Resource Management Authority (WARMA), Ministry of Environment and Natural Resources and Kenya Industrial Research Development Institute (KIRDI), as well as policy and legal issues associated with environmental protection and management of tannery waste.

The study sought to examine the roles of different stakeholders such as Kenya Association of Manufacturers (KAM), Kenya Leather Development Council (KLDC) AND United Nations Industrial Development (UNIDO), on matters concerning industrial waste management hence closing the gap that have been left out on tannery waste management cycle.

1.5 JUSTIFICATION AND SIGNIFICANCE OF THE STUDY.

Pollution is a widely researched phenomenon, not only from the global scale but locally as well. In Thika town the issue has received a lot of attention from political and media circles with campaigns to address pollution issues. However, there are no clear methods established in a bid to control the issue in Thika industrial area and its environs.

Tannery waste generated from these industries are not properly managed due to lack of a clear policy framework to guide and streamline the sector through proper laws, policies and clear guidelines that bring in all stakeholders.

Findings from this study will therefore come up with effective recommendations that will seek to streamline the governance of tannery effluent discharge in tannery sectors in Thika town industrial area region.

Moreover, this will ensure functional systems and structures are put in place to ensure proper tannery waste disposal management hence reducing significantly the human and environmental effects.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction.

This Chapter highlights empirical literature written by articulated scholars and researchers with reference to the factors that influence sustainable tannery waste management in urban areas. This Chapter is arranged in the following sections: Section 2.2 examines the Meaning and Scope of Hazardous Waste; Section 2.3 examines Environmental Bearings of Leather Industry Effluents; Section examines 2.3.1 examines the Effects on Surface Water; Section 2.3.2 examines the Effects on Terrestrial; Section 2.3.3 examines the Effects on Ground Water; Section 2.3.4 examines the Effects on Human Health; Section 2.4 examines State of Leather Industry in Kenya; Section 2.5 examines Role of National and County Governments in Management of Natural Resources in Kenya; Section 2.6 examines the Kenyan Policy and Regulation on Hazardous Waste Management; Section 2.6.1 examines The Constitution of Kenya 2010; Section 2.6.2 examines The National Environmental Policy 2014; Section 2.6.3 examines The Environmental Management and Coordination Act 2019; Section 2.6.4 examines The Health Act 2019; and Section 2.6.5 examines The Draft Toxic and Hazardous Chemicals and Material Management Regulation 2019; Section 2.7 examines The Role of Environmental Standards in the Governance on Chemical and Hazardous Waste Disposal; Section 2.7.1 examines The Water Quality Standards and Conditions for Discharging Effluents; Section 2.7.2 examines Enforcement of Water Ambient or In-stream and Effluent Discharge Standards. Section 2.8 examines The Role of Air Quality Standards; Section 2.8.1 examines Enforcement of Emission Standards; Section 2.9 examines the Current Legislation on Tannery Effluent Management; Section 2.10 examines the Theoretical Framework; Section 2.10.1 examines the Ecological Modernization Theory; Section 2.11 examines the Conceptual Framework and lastly Section 2.12 examines Chapter Summary.

2.2 Meaning and scope of Hazardous Waste.

According to Verschuuren, the concept of hazardous waste has no specific or global definition; however related meanings are used in a number of countries as well as the United Nation Organization. Furthermore Verschuuren goes ahead to deposit the definition of hazardous waste as given under UNEP which it states as; *“Wastes other than radioactive wastes which, by reason of their chemical reactivity, toxic, explosive, corrosive or other characteristics causing danger to the health or the environment, whether alone or coming into contact with other wastes, are*

legally defined hazardous in the state in which they are generated or in which they are disposed of or through which they are transported.”⁵⁴

According to an illustrative example definition of hazardous waste given by Justice Nordberg in the case of *Agricultural Excess & Supplus Inc. Co. v. ADB Tank & Co*⁵⁵ where it was defined as “*any solid or liquid waste which due to its quantity concentration or physical, chemical or infectious characteristics may cause or considerably contribute to a rise in mortality or a rise in serious irreversible or unhealthful reversible ill health or create a considerable gift or potential hazard to human health; once improperly treated, stored, transported or disposed of.*”

Again Art. 2(1) of Basel convention defines wastes as: “*substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law.*”⁵⁶

Pearce argues that waste can be released in three forms namely; solid, liquid or gaseous form. He further adds that wastes are generally defined either by their source or by their characteristics.⁵⁷ More-so, the Basel Convention goes ahead defines what hazardous wastes are and it provides as follows;

“Waste that belong to any category contained in Annex I of the Basel convention which includes; dyes, inks, medical waste, waste from wood preserving chemicals, pigments and residues from industrial waste disposal and which possess any of the characteristics contained in Annex III including; explosive, flammable, unstable and poisonous form.”

From the three definitions it is quite evident that in the context of industrial waste, more specifically tannery waste which contains chemicals which tend to pose a potential or present threat to human health and the environment due to improper discharge of toxic effluent. Reason being that during tanning process some of the toxic chemicals used in the refining of the hides into leather are not a hundred percent eliminated during disposal, thus resulting to the same being

⁵⁴ Verschuuren, *Sustainable Development and the Nature of Environmental Legal Principles*. Potchefstroom Electronic Law Journal, Vol 9, No.1 (2006), p.52.

⁵⁵ 878 F. Supp.1091, 1096 (N.D. III. 1995).

⁵⁶ Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal (Adopted on 22nd March 1989, entered into force in 1992.), Article 2(1).

⁵⁷ Fred Pearce, *Beyond Rio, green economics can give us hope*. (2012): The Guardian available at; <http://www.guardian.co.uk/environment/series/guardian-environment-network> (Accessed on November 2, 2018).

freed into the environment and thus resulting to the irreversible effects on human health and the environment as well.

2.3 Environmental Bearings of Leather Industry Effluents.

According to a previous study done by Belay, the leather industries are the major contributors of water pollution through its effluent discharge which has become a potential concern. Tanning trade effluent poses grave ecological effect on water with its high oxygen demand, discoloration and deadly compound constituents. Tannery effluents characterization comprises a posh muddle of each carbon-based and mineral pollutant.⁵⁸

2.3.1 Effect on Surface Water.

In a previous study done by Richardson, findings show that that tannery effluent comprises of large quantities of toxic contaminant compounds such as lead, zinc, copper and chromium metals which destroy the physical, chemical and biological composition of the surface water. He further points out that due to the heavy loads of these toxic contents in the surface water, it consumes all the oxygen in the water thus affecting the temperature preference of living organism and animals in the water resulting to retardation growth in fish, alteration of feeding habits in fish as well as death of aquatic animals and plants. Reason being that this tannery effluents contain very harmful or toxic compounds such as chromium VI and sulphide salts which do not dissolve in water and which absorbs all the oxygen in the water thus destroying habitats in the water and resulting to salinity of the water rendering it unsafe for consumption.⁵⁹

Furthermore, Belay adds on that increase of loads of harmful or toxic compounds in tannery activities results in the contamination of water sources thus affecting the normal consumption of water due to the reducing of the water quality due to adulteration. He further adds on that tannery activities have to be regulated so as to ensure the aspect of standard and quality control is adhered to so as to conserve the water sources for domestic use.⁶⁰

⁵⁸ Alebel Abebe Belay: *'Impacts of Chromium from Tannery Effluent and Evaluation of Alternative Treatment Options,'* (2010). Diary of Environmental Protection, 4-5.

⁵⁹ Benjamin J. Richardson, *Socially Responsible Investment Law: Regulating the Unseen Polluters*, (2008), USA: New York, Oxford University Press, p.524.

⁶⁰ Dima, W. Nazer, R.M.S. (2006). *Reducing the Environmental Impact of the Unhairing/liming process in the Leather Tanning Industry*. Journal of Cleaner Production 14 (2006), 1.

2.3.2 Effect on Terrestrial

In a previous study Karabay illustrates that increase of toxic tannery effluents into the water results to the escape of the toxic compounds into the land especially irrigation lands which are generally situated near rivers or lakes. The Study indicated that the in instances where the contaminant load is more than the neutralizing capacity of the soil, it is mostly likely to cause destruction of the soil structure as the salt content from the pollutant compound is high.⁶¹ Thus this discharge of these tannery pollutants will only hinder effective farming and cultivation which raises the need of monitoring of these tannery activities so as to ensure the standard and quality of effluent discharged is not harmful to the environment.⁶²

On the other hand, Mandal points out that tannery effluents comprise of very toxic or poisonous compounds such as zirconium, sodium, chloride, lead, copper and chrome which when released into land through surface water will affect plant growth as they hinder growth of normal soil bacteria that helps in adding of nutrients in the soil to make it fertile as land pollution would eventually result to ground water pollution due to great levels of salt contents in the pollutant compounds.⁶³

2.3.3 Effect on Ground Water

According to Nazer, the ground water has a less self- purification aspect than that of surface water as ground water has minimal contact with air. Therefore ground water pollution can only be evident if the contaminant compounds seep through the soil, leaks through underground waste pipes and gets into contact with the ground water thus adulterating the quality of the water for domestic and irrigational use.⁶⁴

2.3.4 Effect on Human Health

According to Mandal, tannery effluents are highly loaded with very toxic compounds which can be lethal if ingested by humans especially through the consumption of polluted water.⁶⁵ He further explains that these toxic compound found in tannery effluents include; chrome, sulphide,

⁶¹ Dima, W. Nazer, R.M.S. (2006). *Reducing the Environmental Impact of the Unhairingeliming process in the Leather Tanning Industry*. Journal of Cleaner Production 14 (2006), 1.

⁶² Secil Karabay: *Introduction to Leather Process*. In Secil Karabay, WASTE MANAGEMENT IN THE LEATHER INDUSTRY, (2008) (pp. 4-8). Izmir.

⁶³ Sathiyamoorthy Mandal., V.D: *Prepation of Eco-friendly Leather by Process Modification to Make Pollution Free Tanneries*, (2013). Journal of Engineering, Computers & Applied Sciences (JEC&AS), 4-5.

⁶⁴ Dima, W. Nazer, R.M.S. (2006). *Reducing the Environmental Impact of the Unhairingeliming process in the Leather Tanning Industry*. Journal of Cleaner Production 14 (2006), 1.

⁶⁵ Sathiyamoorthy Mandal., V.D: *Prepation of Eco-friendly Leather by Process Modification to Make Pollution Free Tanneries*, (2013). Journal of Engineering, Computers & Applied Sciences (JEC&AS), 4-5.

zirconium, lead, copper, titanium, and nitrogen which again if is in excess in the water and consumed can result to grave health threats of infants. Important to note is that this pollutants will be bio-concentrated and reach the human-beings through the food chain and the results will vary from severe symptoms such as skins cancer due to chromium compound, gastric, respiratory, liver, cancer as well as nervous and immune system complications.⁶⁶ With all these effects it is evident that the government has not sensitized its mandate to regulate tannery activities. However, Kenya has adopted the sustainable development goals which the aspect of health is paramount in ensuring that the economy is stable. In so mentioning, then the government has to ensure that effective enforcement of tannery effluent discharge is in line with the standard and quality control regulations in view of ensuring that the natural water sources are protected against pollution.

2.4 State of the Leather Industry in Kenya.

Kenya is a country with a long tradition of handling leather. In this industry, the increase in tanning from 9% to 11% with a pressing restructuring of 2% is a clear indication of growth.⁶⁷ This was also demonstrated in the recent economic study of 2008 which showed an increase of 10.3% in the leather industry. Kenya holds the potential to generate significant export earnings for the leather industry through its annual output of hides and pelts.⁶⁸

The tanning industry in Kenya faces a number of challenges with regard to adverse impacts on the environment. In 2008, NEMA ordered the closure of two tanneries as a result of the improper disposal of effluent which polluted the environment. There is increasing concern that some chemicals used in the leather industry and the manner in which industry effluents include toxic substances such as chromium salts will be eliminated.⁶⁹

The 2010 Constitution of Kenya (Chapter 5, Articles 69 and 70) contains several trade, human health and environmental provisions for the tanning industry, such as:

⁶⁶Alebel Abebe Belay: *'Impacts of Chromium from Tannery Effluent and Evaluation of Alternative Treatment Options,'* (2010). Diary of Environmental Protection, 4-5.

⁶⁷ Muchangi, J. (2012), "The star" Kenya's Leather Industry Rising from the Ashes. N.P, 15th April 2012 < http://www.the-star.co.ke/business/features/71549_while_leather_traders_are_smiling>

⁶⁸ Muchangi, J. (2012), "The star" Kenya's Leather Industry Rising from the Ashes. N.P, 15th April 2012 < http://www.the-star.co.ke/business/features/71549_while_leather_traders_are_smiling>

⁶⁹ Muchangi, J. (2012), "The star" Kenya's Leather Industry Rising from the Ashes. N.P, 15th April 2012 < http://www.the-star.co.ke/business/features/71549_while_leather_traders_are_smiling>

- Select all measures to forestall or minimize environmental harm and destruction, letting in water resources resulting from pollution or other types of natural resources.
- Implement all practical measures to promote a good water management system at all levels.
- Encourage sustainable development and sensitize the public to the need to manage land, gentle wind and water resources in a balanced and sustainable way for current and future generations.
- As per Article 42, everyone has the right to a clean and healthy environment.
- Implement measures to protect and preserve the environment from abuse, pollution and degradation; manage the environment for sustainable development; and promote environmental awareness.

Although these policies are well known in the tanning sector, they are not followed primarily due to a lack of enforcement.⁷⁰

According to Belay, Kenya is one among many countries in the Africa that is richly loaded with natural resources. In reference to leather production, livestock is the major natural resource in Kenya contributing about 12% of the nation's GDP.⁷¹ Thus, this means that the majority of these hides and skin comes from slaughter houses which again explain that the livestock trade has tremendously increased to about 4% annually in Kenya.⁷²

The high demand of leather products has led to the increase of leather industries, however little effort has been done by the national and county government in regulating tannery activities resulting to deterioration of the environment more-so pollution of the water sources.⁷³

A good example is a case scenario in Thika town in Kiambu County where sometime in 2017 a Chinese factory by the name Time Unit Limited was accused on discharged toxic effluents into Chania River leading to a number of residences within the area to develop severe health

⁷⁰ Muchangi, J. (2012), "The star" Kenya's Leather Industry Rising from the Ashes. N.P, 15th April 2012 < http://www.the-star.co.ke/business/features/71549_while_leather_traders_are_smiling>

⁷¹ Alebel Abebe Belay: 'Impacts of Chromium from Tannery Effluent and Evaluation of Alternative Treatment Options,' (2010). Diary of Environmental Protection, 4-5.

⁷² Nazer W. Dima, R. M.-S. Reducing the environmental impact of the unhairing/liming process in the leather tanning industry, (2006). Journal of Cleaner Production 14 (2006), 1.

⁷³ Manjushree Chowdhury, Akbar Mostafa, Tapan Kumar Biswas, Ananda Kumar Saha. Treatment of leather industrial effluents by filtration and coagulation processes. (2013) Science Direct, 1-2.

complications. Most interesting is that the allegations were made by the former Member of Parliament Alice Nga'nga and a Member of County assembly by the name Wangari, but shockingly enough no action was ever taken against the administrators of the industry even after several closure notices issued by NEMA.⁷⁴

Belay in his argument further sensitizes that Kenya has faced a big trial in ensuring sustainable management of tannery activities. More-so there is need to ensure effective monitoring systems are put in place so as to regulate tannery activities thus preventing water pollution due to tannery effluent discharge which will compromise the protection and conservation of the environment.⁷⁵

2.5 Roles of National Governments and Counties in Natural Resource Management in Kenya.

The primary objective of the transfer is to delegate the powers, functions and management of resources at the local or county level, the primary objective of which is to improve efficiency, participation and environmental sustainability.⁷⁶

Devolution which also refers to decentralization can be defined as; *“the restructuring or reorganization of authority so that there is a system of co-responsibility between institutions of governance of the central region and local levels according to the principle of subsidiarity thus increasing the overall quality and effectiveness of the system of governance, while increasing the authority and capacities of sub-national levels.”*⁷⁷

⁷⁴ <https://citizentv.co.ke/news/why-government-could-shut-down-a-kiambu-based-chinese-company-186248/> accessed on 15th August 2019.

⁷⁵ Alebel Abebe Belay: 'Impacts of Chromium from Tannery Effluent and Evaluation of Alternative Treatment Options,' (2010). Diary of Environmental Protection, 4-5.

⁷⁶ 'Policy, Legal and Institutional Framework Governing Environmental Management in Kenya, available at < [http://www.tanariverdelta.org/tana/975DSY/version/default/part/Attachment Data/data/MUMIAS Tana EIA part 5.pdf](http://www.tanariverdelta.org/tana/975DSY/version/default/part/Attachment%20Data/data/MUMIAS_Tana_EIA_part%205.pdf) (Accessed on 5/11/2020).

⁷⁷ Juma T., Rotich J. and Mulongo, L, “Devolution and Governance Conflicts in Africa: Kenyan Scenario,” Public Policy and Administration Research, Vol, 4 No 6 2014, p.4.

Delegation was warranted for a number of reasons. It enables counties to accurately identify and prioritize their environmental issues and facilitate the tracking of resource use.⁷⁸ The goal of devolution is to improve the operation of government by making it more accountable and responsive to citizens' demands and ambitions by ensuring that no development activity impacts their enjoyment and use of the environment; and⁷⁹

In respect to Annex four of the Kenyan Constitution which outlines the functions of the national and county governments in respect of the management and protection of the natural resources in the counties which is geared to establishing a sustainable and developed system of protecting water sources in particular.⁸⁰

The goal of county assemblies is also to play a part in national resource management and policy development, among other matters. Nevertheless, the constitutional division remains the responsibility of national governments and counties to ensure use and management of natural resources.⁸¹

The County Government Act 2012 provides reasonable access to the procedure for developing and enforcing policies, laws and rules, including approving development projects and budgets and setting specific performance criteria.⁸²

More importantly, the national government can continue to play a role in the protection of a variety of natural resources, such as rivers, lakes, and so on. By instituting policies, legal and societal frameworks and conditions for county management to oversee and regulate private

⁷⁸ Nduta R.W., Shisia, A., Kamau, G. and Asienga, I., "Challenges Facing Public Resources Management of Developed Governments in Kenya: A case of Machakos County." International Journal of Economics Commerce and Management, Vol V, Issue 9, September 2017.

⁷⁹ Final Report of the Task force on Devolved Government, Vol I (Office of the Deputy Prime Minister and Ministry of Local Government, (Government Printer, Nairobi 2011).

⁸⁰ ⁸⁰ Chitere, P., Chweya, L., Masya, J., Tostensen, A. and Waiganjo, K., 'Kenya Constitutional Document: A Comparative Analysis, CMI Reports, 2006. Available at <http://www.cmi.no/publications/file/2367-Kenya-constitutional-documents.pdf> (Accessed on 5/11/2020).

⁸¹ Final Report of the Task force on Devolved Government, Vol I (Office of the Deputy Prime Minister and Ministry of Local Government, (Government Printer, Nairobi 2011).

⁸² Chitere, P., Chweya, L., Masya, J., Tostensen, A. and Waiganjo, K., 'Kenya Constitutional Document: A Comparative Analysis, CMI Reports, 2006. Available at <http://www.cmi.no/publications/file/2367-Kenya-constitutional-documents.pdf> (Accessed on 5/11/2020).

activity and ensure sustainable production and consumption without reducing the quality of the receiving environment.⁸³

⁸³ Nduta R.W., Shisia, A., Kamau, G. and Asienga, I., “Challenges Facing Public Resources Management of Developed Governments in Kenya: A case of Machakos County.” *International Journal of Economics Commerce and Management*, Vol V, Issue 9, September 2017.

2.6 Kenyan Policy and Regulation on Hazardous Waste Management.

Kenya is indeed interested in the various treaties and international agreements relating to chemical substances. In addition, the country has a variety of organizations with explicit strategies and legislation to monitor hazardous waste. The Ministry of Environment and Natural Resources in unison with regulatory institutions such as NEMA undertake a foundational work in the preservation and conservation of the environment that ensures decoupling the progress of natural corruption within any segment.

2.6.1 The Constitution of Kenyan2010.

Article 42 of the Constitution grants all Kenyan citizens the right to a healthy and seamless environment. This right is accompanied, in Article 69, by the responsibility of the State to defend the environment when a duty is imposed on citizens. To a greater extent-so Article 70 mandates the State to guard and preserve the environment

It is all-important to note that the new Constitution ushered a new devolved machine of governance which created forty seven counties. Each county is required to plan its own quality environmental governance practices in accordance with the Constitution, Kenyan legal directives and guidance for resource management as stipulated by NEMA regulations. Again, they are also required to take budgetary measures to deal with issues such as hazardous waste management.

2.6.2 National Environmental policy 2014.

The objective of the 2014 National Environmental Policy is to provide a holistic framework to guide the management of the environment and natural sources in Kenya. Its aspiration is an integrated approach to the administration of the environment to issues that include hazardous waste which includes hazardous chemical waste in all insurance policies of the authorities in order to facilitate and achieve a sustainable improvement in every grade.⁸⁴ Still, it carries numerous guiding ideas relevant to sound chemicals administration and waste, some of which include; right to healthful and clean surroundings, proper with development, sustainable aid use,

⁸⁴ Oruko, Richard & Moturi, Wilkister & Mirona, John. (2014). *Assessment of tannery based solid wastes management* in Asili, Nairobi Kenya, p18.

public participation, precautionary principle and polluter pay principle. This concept observes to the chemicals and waste management approaches that are germinated.

In addition, concerning the company and the environment, environmental coverage requires an environmentally-friendly approach to industrial development that integrates and promotes user-friendly development, and environmental policies thus enhance the transfer of environmentally-friendly technologies.⁸⁵ As well, with respect to waste management, coverage recognizes the importance of chemical compounds in the national development process. In addition, it acknowledges that in the administration of chemicals, there is no governing policy because of this absence; Kenya is vulnerable to the risks and hazards associated with chemicals. All the same, the policy does now not particularly point out how these chemical wastes are to be released or managed after use.

2.6.3 Environment Management and Co-ordination Act, 2019.

It is the framework regulation of the environmental administration in Kenya. The Act established the National Environmental Management Authority (NEMA) as the primary instrument of the authorities charged with implementing and enforcing environmental policies. More importantly, management of chemical compounds is provided for in part ninety one up to section ninety three two inclusive of development of standard criteria for classification of poisonous and hazardous substances, improvement of guidelines and rules for the management of each class of hazardous and toxic wastes and manage of imports, exports and transportation of toxic and hazardous chemical compounds and materials.⁸⁶

The Act also sets out the problems associated with the release of hazardous materials or chemical substances into the environment, as well as the responsibility and punishment of spillers. Once more in regards to chemical waste covered under the Act includes; industrial, fertilizers, client chemicals and oil products.⁸⁷

2.6.4 The Health Act 2019 (Amended).

The Act establishes a unified health care system to coordinate the relationship between the national government and the county government's health care systems to provide for legislation on health care services and health care providers and health-care.

⁸⁵ Oruko, Richard & Moturi, Wilkister & Mironga, John. (2014). Assessment of tannery based solid wastes management in Asili, Nairobi Kenya, p15.

⁸⁶ Section 91-93, EMCA No.18 of 2018 Amended L.N 31 OF 2019.

⁸⁷ Section 72, EMCA No.18 of 2018 Amended L.N 31 OF 2019.

With respect to Phase VI of the Act, it addresses “promoting and advancing the health of the public and the environment”, which is particularly relevant to the challenge of chemicals and waste management.⁸⁸ Subsection 38(2b) provides for the reduction of the burden of disease caused by environmental hygiene, sanitation, occupational exposure and environmental pollution.

2.6.5 Draft Toxics and Hazardous Materials Management Regulations 2019.

Kenya has made great strides towards the implementation of a regulation of dangerous chemicals, however with the finalization of the draft regulation which borrowed various regulations from the European Union as well as from African states. As such, this new regulation will align Kenya with the seventh edition of the Globally Harmonized System (GHS) for the classification of chemicals.⁸⁹

The regulatory proposal developed by the Chemicals Section of NEMA includes:⁹⁰

- Classification and registration of hazardous substances and products.
- Limiting and prohibiting hazardous substances and chemicals.
- Manufacturing, importation and exportation, including provisions on safety data sheets and chemicals.
- Distribution, storage, transport and handling of dangerous chemicals and materials.
- Elimination of hazardous chemical waste and creation of a record of pollutant releases and transfers.

Yet the draft ordinance does not turn over any definition on what hazardous waste is or what waste is in general which is comprehensively covered under EMCA 2019.

⁸⁸ Part VI of Health Act Amended No. 5 of 2019.

⁸⁹ <http://www.kenyalawresourcecenter.org/2011/07/management-of-hazardous-chemicals.html> accessed on 8/10/2019.

⁹⁰ http://www.nema.go.ke/images/Docs/Regulations/Draft%20Chemical%20Regulations%202018_%20FINAL_27.08.2019.pdf accessed on 8/10/2019.

2.7 The Role of Environmental Standards in the Governance on Chemical and Hazardous Waste Disposal.

2.7.1 Water Quality Standard and Conditions for Discharging Effluents.

The water quality standards are also called the ambient or in-stream standards and are enforced together with the effluent discharge standards in order to effectively maintain the quality of the water resource. The in-stream standards by nature reflect the assimilative capacity of the water resource to receive effluents and other abuses that may be discharged, deposited or emitted into it. The effluent discharge standards are those that apply to material being discharged to the receiving environment and in this case the aquatic environment.⁹¹

These effluents are harmful to varying degree and require treatment to minimize their impact onto the aquatic environment. The standards will prescribe their conditions for discharge depending on the nature of the effluent no matter where it is going to be discharged. The in-stream standards, and conditions for discharging effluent if at all, will be applied on certain protected water resource wherein certain pollutants may be prohibited.⁹²

Examples of protected areas that may need the standards and guidelines urgently are; lake shores, wetlands, coastal zones or river banks, fishing areas, aquatic areas, water resources, reservoirs and other environments which need absolute protection or certain level of protection. Absolute prohibition of dumping hazardous substances in protected water resources or emissions into a protected area is a way of maintaining environmental quality standards. The effluent may require physical, chemical treatment, sea disposal, or water recycling before discharging into the public sewer or open streams.⁹³

There are many instances in the country where effluents are being discharged into water resources. The Instances include; Pan African Paper Mills, in Webuye, which discharge into the Nzoia River, Kenya Breweries Ltd discharging into Ruaraka River, the East African sugar

⁹¹ Section 3, Water Quality Regulations, 2006.

⁹² Section 6, Water Quality Regulations, 2006.

⁹³ Section 11, Water Quality Regulations, 2006.

industries Muhoroni discharging into the Nyando River and the Kenya Cannery Ltd, in Thika discharging into the Thika River.

The function of in-stream standards and effluent discharge requirements is to maintain the aquatic environment and allow many to make use of the water resources. The in-stream standards will be prescribed for all water resources defined as, "*Any lake, pond, swamp, marsh, stream, water course, estuary, aquifer, artesian basin or other body or other body' of flowing or standing water whether or not above or under-ground.*"⁹⁴

By prescribing water quality standards on the basis of water uses will not only protect all water resources from various abuses and pollutants, but also allow optimum utilization of water resources that hitherto, have been impaired and unappreciated.

2.7.2 Enforcement of the Water Ambient or In- Stream and Effluent Discharge Standards.

The enforcement of water quality standards has been by generalized charges under the penal code, which criminalizes voluntary 'fouling' or 'corruption' of water of any public spring, or reservoir so as to render it less in shape for the purpose for which it is generally used. The merchant shipping act covers the marine environment of up to one hundred miles but only in relation to discharges of oils.⁹⁵ There are numerous other sectoral laws, for the protection of water resources, including the public health act which refers to polluting activities and specific pollutants that are to be controlled. This mainly relates to drinking water and its sources. The acts also specify the unique water our bodies and aquatic existence for which protection is to be sought.⁹⁶

However the legislations for which pollution is monitored do not have and have never had prescribed in-stream standards and or discharge of effluent guidelines. The charges for water pollution are thus unspecific. For instance they refer to discharges that are likely to be 'injurious' or 'harmful' or 'poisonous,' 'corrupting' and , 'fouling' while not defining the terms 'pollution' 'effluent' and 'waste'.⁹⁷ These terms leave the magistrates to determine what pollution to

⁹⁴ Section 3, Water Quality Regulations, 2006.

⁹⁵ Section 2, Water Quality Regulations, 2006.

⁹⁶ Section 6, Water Quality Regulations, 2006.

⁹⁷ Section 11, Water Quality Regulations, 2006

constitute an offence is. These are the anomalies therefore that the standards and enforcement review committee are to review and recommend the appropriate standards and guidelines for the protection of the aquatic environment.⁹⁸

This is not the case now under the new water act, and EMCA, which prescribe severe penalties for the water pollution offence and for flouting effluent discharge conditions. They prescribe specific charges that will be based on proven evidence and heavy penalties accompanied with cleanup measures and compensation for the damage.⁹⁹ There are to be formulated, conditions for discharge of effluents, which will be based on the assimilative capacity of the water resource, and prescribed treatment for any discharges into public sewers.

2.8 The role of Air Quality standards

Air quality standards refer to ambient air great standards, occupational air satisfactory standards, emission standards from constant sources and these from mobile sources. The ambient air has been defined as the “*atmosphere surrounding the earth but does not include the atmosphere within a structure or within any underground space.*”¹⁰⁰ This has not been a subject of regulation before in any of the statutes in Kenya. However there have been some guidelines in isolating air polluting activities, such as industrial areas from residential areas to protect human health.¹⁰¹

Zoning areas to protect the environment against air pollutants, is a way of maintaining minimum air quality standards. Examples in Kenya would be designating industrial areas to be away from the central business district, and residential areas. In that the ambient air quality has to be at safe level of air pollutants.¹⁰²

The pollution media that need quality standards is air water and soil due to effluents discharged from the industries and plants, into sewages, water bodies and open land, emissions into the air. Creating controlled areas is however not enough to control air pollution which is known to travel

⁹⁸ Section 24, 27, Water Quality Regulations, 2006.

⁹⁹ Part VIII, Part IX of EMCA No.18 of 2018 Amended L.N 31 of 2019.

¹⁰⁰ Part 1, Section 2 of EMCA Air Quality Regulations 2009.

¹⁰¹ Environmental Management and Coordination Act (EMCA) (2006). Waste Management Regulations, Kenya gazette supplement number 69.

¹⁰² Part III, Section 10(1), (2), EMCA Air Quality Regulations, 2009.

long distances into controlled areas.¹⁰³ The air quality has to be maintained by controlling the pollutants at their sources. This will call for emissions standards from known and fixed sources, combined with process and product standards. Ambient air needs protection due to risks to health, acid rain, and Ozone depletion among other known reasons. In the air is also noise, and smell which have not been subjects of regulation in terms of protecting the environment. There are no ambient air standards in Kenya.¹⁰⁴

2.8.1 Enforcement of Emission standards.

Emission standards set levels for pollutants not to be exceeded from, fixed and mobile installations or activities being carried out. For instance, automobiles, aircrafts, and industries in fixed sources. The said standards have the role of arresting the air pollution at source, as opposed to isolating places as controlled areas. Since these sources are known to cause air pollution, if they can be controlled by prescribing emissions standards which must not be exceeded, the regulations will contribute to the reduction of air pollution in the country.¹⁰⁵

The current law in emission of pollutants into the ambient air is scattered in several statutes. The penal code calls air pollution 'foul air' which affects the health of others. This could be by industrialists, and manufactures. The 'foul air' also refers to "noise" and "smell."¹⁰⁶

Due to lack of controls that are yet to be put in place under EMCA, prosecutions of those bad smells that "affect comfort and convenience especially of use of amenities are yet to be done. This will see controls enforced for tanneries, and paper mills which emit such nose rendering smells.¹⁰⁷ Thus the measure and determination of noxious smells are yet to be established. This would require determining its origin whether caused by human activity or from natural causes and set the minimum standards for its control. The offence would then be contravening the set standards for smells and the general penalty for contravening any set standards under EMCA.¹⁰⁸

¹⁰³ Part IV, Section 11, 12 &13, EMCA Air Quality Regulations, 2009.

¹⁰⁴ Part IV, V&VI, EMCA Air Quality Regulations, 2009.

¹⁰⁵ Part III, IV, EMCA Air Quality Regulations, 2009.

¹⁰⁶ Chapter XVII, Section 192, Penal Code (CAP 63) Revised Edition (2014).

¹⁰⁷ Mwiwikione, M., Meharg, A., Dawson, J., Norval, J.C.S., and Killham, K. (2005). *An Eco toxicological Approach to Assessing the Impact of Tanning Industry Effluent on River Health*. Natural defilement toxicology, 50, 316-324.

¹⁰⁸ Part XIII, EMCA No.18 of 2018 Amended L.N. 31 of 2019.

2.9 Current Legislation on Tannery Effluent Management in Kenya.

In comparison to the Western European environmental laws, the Kenyan environmental law standards are apparently considered to be lower, reason being that there is ineffective implementation of regulation governing standards and criteria control on industrial activities.¹⁰⁹

In regards to majority of the Companies in Kenya which are entirely alert of the gaping hole in the environmental laws and benefited from situation.¹¹⁰

The amended EMCA is indisputably a positive step, in the eradication of environmental management violation by industrialists, where section 92 of the amended EMCA mandates the National government as well as the County government to set up monitoring systems so as to ensure proper standards and control violation as a result of industrial effluent disposal.¹¹¹

According to Bosek, Kenya Bureau of Standards (KEBS) is mandated to prepare standards relating to industrial products and assisting in the production of quality goods as well as improving the measurement of accuracy in relation to standards.¹¹²

With the introduction of the new revised EMCA, there have been some remarkable improvements to effluent discharge standards and regulations on discharge of hazardous substances or chemicals. The Environmental Management and Co-ordination (Water Quality) Regulations¹¹³ which emphasizes on the protection and conservation of natural water resources by providing articulate guidelines and regulations on standard and quality control of effluent discharge by industries so as to deter dumping of any toxic contaminant which will affect the quality of the water.

In reference Section 108 of the Water Act¹¹⁴ outlaws trade premises from discharging any trade effluent without the consent of the licensee. More-so, Section 36 of Water Act¹¹⁵ offers for

¹⁰⁹ Ogolla Bondi and Ojwang Shadrack Otieno: *in International Encyclopedia of Environmental Law(s)* [Kenya section] (Kluwer Law International, (1999).

¹¹⁰ Joel Kimutai Bosek: *Implementing environmental rights in Kenya's new constitutional order: Prospects and potential challenges*. African Human Rights Law Journal, (2014) 14(2), 489-508.

¹¹¹ Section 92, EMCA No 18 of 2018 Amended L.N. 31 of 2019.

¹¹² Joel Kimutai Bosek: *Implementing environmental rights in Kenya's new constitutional order: Prospects and potential challenges*. African Human Rights Law Journal, (2014) 14(2), 489-508.

¹¹³ Environmental Coordination and Management Act; Water Quality Regulations (2006).

¹¹⁴ Water Act No. 43 of 2016, Section 108.

permits of discharge of pollutants into any water source and also under section 77¹¹⁶ of Water Act, provides for County government establishment of Water Service Providers who have also an obligation to monitor water quality standards, but fails to address the issue waste treatment before disposal of the waste water effluent into water sources.

The Hides, Skin and Leather Trade Act¹¹⁷ again provides for licensing as well as quality and standard regulations of the leather production during the tanning process, but fails to address the issue of waste treatment and waste disposal during the leather production.

The new revised EMCA¹¹⁸ under Section 72, 93(1)¹¹⁹ and 141(f)¹²⁰ prohibits dumping or release of toxic material or compounds into any water source. Similarly Section 93(3) and 142 (1), (2) provides for punishment of offenders as well as the offender bearing the cost of cleaning the hazardous substance in the environment. Again Section 92 affords for monitoring on the effect of hazardous chemicals on human health and environment.¹²¹

The Kiambu County Water and Sanitation Act¹²² which is the only county by law instrument that regulates water resources management and water and sanitation. The Act is concerned in water services, sustainable management of water resources such as rivers, ground waters within the county as well as water and soil conservation, storm water management and pollution control.

According to this Act, section 45(1) provides for compliance of individuals as well as industries to adhere to the effluent standards prescribed by national regulators as well as county regulators.¹²³ This section apparently applies to all industries including tanneries as the county lacks a specific regulation on tannery waste management.

Furthermore, section 45(2)¹²⁴ of the same Act provides for penalties or fines due to non-compliance of section 45(1), where it sets out a fine of one million shillings for a corporate body

¹¹⁵ Water Act No. 43 of 2016, Section 36.

¹¹⁶ Water Act No. 43 of 2016, Section 77.

¹¹⁷ Hides, Skin and Leather Trade Act No. 17 of 2006.

¹¹⁸ Environmental Management and Coordination Act, No.18 of 2018, Amended L.N 31 of 2019.

¹¹⁹ Environmental Coordination and Management Act No. 18 of 2018, Amended L.N 31 of 2019, Section 93(1).

¹²⁰ Environmental Coordination and Management Act No. 18 of 2018, Amended L.N 31 of 2019, Section 141(f)

¹²¹ Environmental Coordination and Management Act No. 18 of 2018, Amended L.N 31 of 2019, Section 92.

¹²² KIAMBU COUNTY GOVERNMENT Water and Sanitation Act No. 2A of 2015.

¹²³ KIAMBU COUNTY GOVERNMENT Water and Sanitation Act No. 2A of 2015, section 45(1).

¹²⁴ KIAMBU COUNTY GOVERNMENT Water and Sanitation Act No. 2A of 2015, section 45(2).

that contravenes section 45(1). Similarly Section 46(1)¹²⁵ provides non-discharge of contaminated water or effluent into any water resource and similarly offers a similar penalty of one million shillings under section 46(2) (a).¹²⁶

Furthermore section 53 (1) of the same act authorizes county enforcement officer to carry out inspections in premises for purposes of enforcement and implementation of the regulations on effluent discharge into water resources.¹²⁷

The ambiguity of these effluent discharge regulations on industrial waste is that they only focus mainly on licensing, storing, transport, handling and release of toxic waste but fail to address the issue of how the monitoring of these industrial activities is to be carried out as well as waste treatment of the hazardous waste before discharge. The status of monitoring bodies is to ensure that these industries do not discharge effluents into the environment which are above the required quantity and standard as stipulated by the regulations. Important to note, is that the responsibility of monitoring is not only solely on government agencies but on the industrialist as well so as to ensure that the effluent being discharged is in harmony with the provisions of the law.

However, most of the bodies which are defined under EMCA such as NEMA, KEBS and County Government (Ministry of Environmental Affairs) essential for implementation and enforcement have failed to enforce monitoring and inspection of tannery activities thus allowing these industries to continue discharging exceeded levels of effluents into the water bodies and disregarding the concept of waste treatment. Thus making it difficult to establish worthy principle standards and control abuse in regards to industrial waste.

2.10 THEORETICAL FRAMEWORK

The study has adopted the theory of ecological modernization.

2.10.1 Ecological Modernization Theory

The theory of ecological modernization is a school of thought that holds that an economy benefits when oriented towards the environment. The hypothesis was first offered in the 1980's by a group of scholars in Berlin who were attending the Free University and Social Science

¹²⁵ KIAMBUR COUNTY GOVERNMENT Water and Sanitation Act No. 2A of 2015, section 46(1).

¹²⁶ KIAMBUR COUNTY GOVERNMENT Water and Sanitation Act No. 2A of 2015, section 46(2), (a).

¹²⁷ KIAMBUR COUNTY GOVERNMENT Water and Sanitation Act No. 2A of 2015, section 53(1).

Research Center. The theory is based on the aspect of eco-efficient innovation, namely the introduction of environmentally friendly technologies that are crucial for the development of more sustainable industrial production and consumption methods.¹²⁸

This theory tends to deviate from traditional environmental regulations which mandated industries to be subjected to rules, control and hierarchy which was meant to make the industries function in certain decorum and failure to follow these rules meant that the industries were penalized through fines, public censures as well as criminal sanctions. It is very evident that this approach of control of command by the authorities in instilling fear to the industries in view of meeting compliance did not allow the same industries to come up with innovative ways or technologies of reducing pollution beyond the prescribed limit.

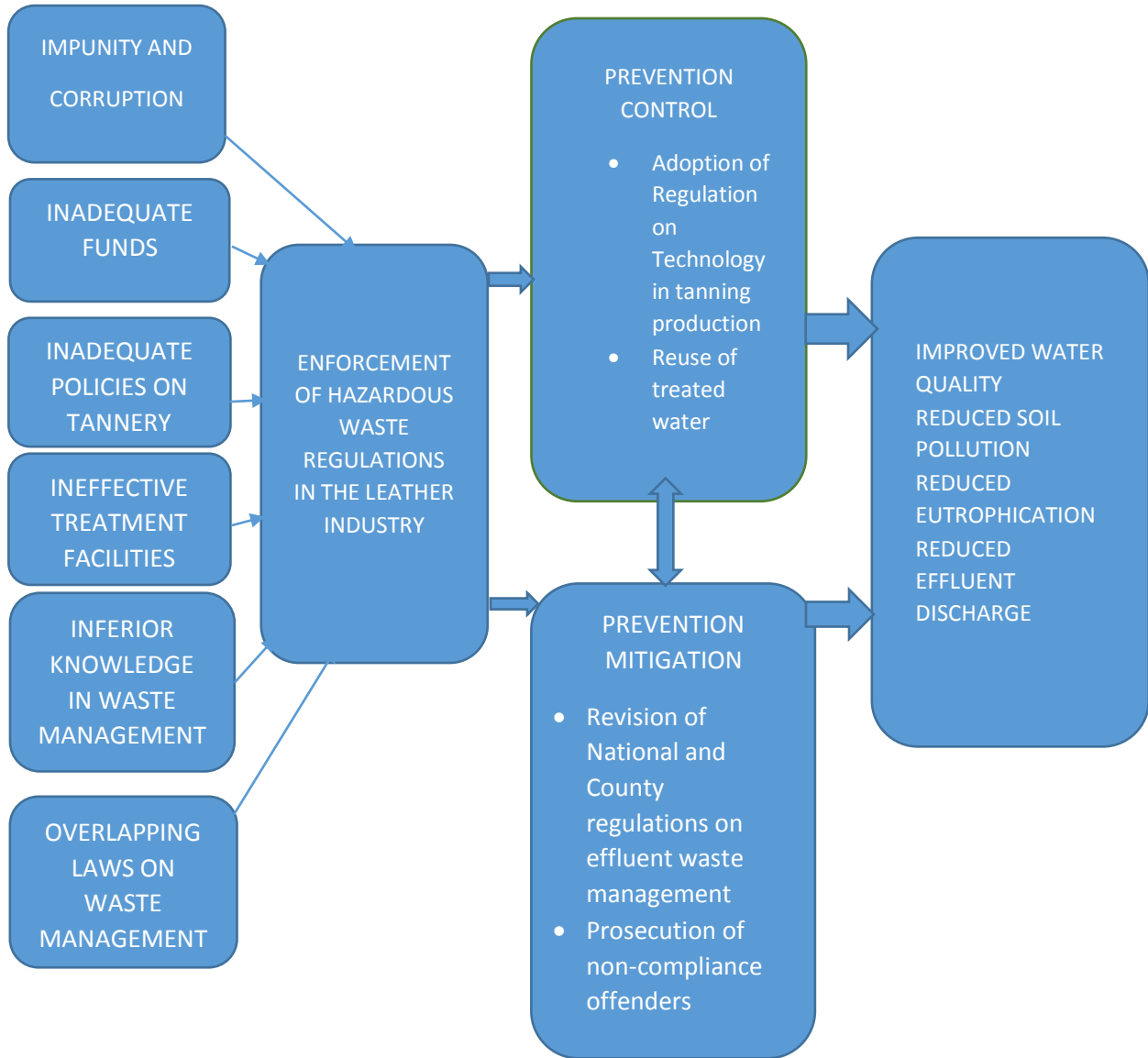
Thus the ecological modernization theory was designed at enabling industries to go beyond environmental compliance and strive for superior environmental performance by conducting technological environmental innovations, meaning that for these industries to improve innovation potential of environmental regulation, its goals and innovation approach have to be driven towards environmental regulations.

The study adopted this theory on the fact that, Kenya being a capitalistic country allows for industries among them tanneries to increase production so as to meet the high demand of supply of goods and services to a vast market, but in doing so, the same tanneries have to comply to the standards and regulations on waste management for effective sustainability of the environment.

However, this has not been the case as these tanneries have continued maximizing profits and continued discharging harmful effluents into the environment exceeding the prescribed limit. The event is not to meet compliance alone, but to have more beneficial ways of production so as to reduce pollution into the environment and still achieve waste that can be well assimilated into the environment with no negative impact on the environment and human wellness as well. Having in mind that the obligation is not exclusively on the national and county government to insure the environment is conserved, but also guarantees that the same tanneries adopt corporate social responsibility in securing their economic activity are in telephone circuit with the public's expectations.

¹²⁸Maarten A.Hajer: *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*, (1995) Oxford, Oxford University Press.

2.11 CONCEPTUAL FRAMEWORK



2.12 Chapter Summary.

This chapter has effectively reviewed literature based on the three research questions listed. A clear illustration of previous studies has been indicated with regards to tannery waste management and the various factors which mostly affect sustainability of tannery waste management.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction.

This chapter gives a description of the target population, research design, research instruments, the primary and secondary data approaches, the sampling techniques employed, and location of the study as well as the data analysis technique employed in the research.

3.1 Research Design

The researcher applied both quantitative and qualitative research design. The mixed design was chosen because it allowed for an in-depth description and understanding of actions and behavior of the participants in an attempt to study the subject from their own perspective.

3.2 Sampling

The researcher adopted purposive and snow ball sampling techniques in the research study. Purposive sampling which is a form of non-probability sampling was preferred because the study targeted people with relevant information on the subject under the study and their availability to fill the questionnaires or purposes of interview.

Snow ball sampling was employed in order for the target respondents to refer other respondents to the study thus enabling the researcher to get more relevant information on the subject study from the respondents.

3.3 Sample Size

The study employed the revised edition 2019 “Research Methods” (Olive M. Mugenda 2003) to calculate the sample size.

The household data collection comprised of two informal settlements namely; Gachagi slum (upstream) and Mwanawikio (downstream). According to Mugenda, the formula used is $N > 10,000$ meaning that the formula is meant for a population of about 10,000, being that the total population for both upstream and downstream is 5,500 comprising of (3000=2500) approximately and which is below the $N=10,000$.

The formula is as follows:

$$n = \frac{z^2 \cdot p \cdot q}{d^2}$$

$$d^2$$

n = refers to the population (Expected to determine)

p.q = refers to the population proportion which means that in like Gachagi slum which has approximately 3,000 people and most likely 50% of the population would likely participate in answering interview questions asked and 50% would decline. That means that the study population proportion is half (50/50).

Z = refers to the critical value of normal distribution.

d = refers to the margin of error which means that there are three levels of significance in determining a normal distribution;

1% > 1.65 (which is the Confidence Level)

5% > 1.96

10% > 1.65

Thus the margin of error for 1% will be $0.01/2=0.005$

The study used 10% as the level of significance which gave 0.1 as the margin of error.

Thus the formula used was;

$$\frac{(1.65)^2 \cdot (1/2) \cdot (1/2)}{(0.1)^2}$$

$$(0.1)^2$$

$$(1.65)^2 \div 4 \div (0.1)^2$$

$$n = 68.0625$$

$$68$$

So as to get my exact sample size for the population of 5,500 which is less than $N > 10,000$, the study used nf (sample size);

$$nf = 68 \times 5500 \div 5568 = \mathbf{67}(\text{sample size})$$

To determine how many people were to be sampled from the two areas, this formula was used:

$$N = N_1 + N_2 (3000 + 2500)$$

$$= 5500$$

$$nf = \mathbf{67}(\text{sample size determined})$$

Area 1 (Gachagi) has a population of approximately 3000 people

$$nA = N_1 \times nf \div N (\text{Total population})$$

$$3000 \times 67 \div 5500 = 36.54$$

$$= \mathbf{37} (\text{people interviewed in this area})$$

Area 2 (Mwanawikio) has a population of approximately 2500 people

$$nA = 2500 \times 67 \div 5500 = 30.45$$

$$= \mathbf{30} (\text{people to be interviewed in this area})$$

Thus $37 + 30 = \mathbf{67}$ (which is the sample size for the household representation of a population of 5500).

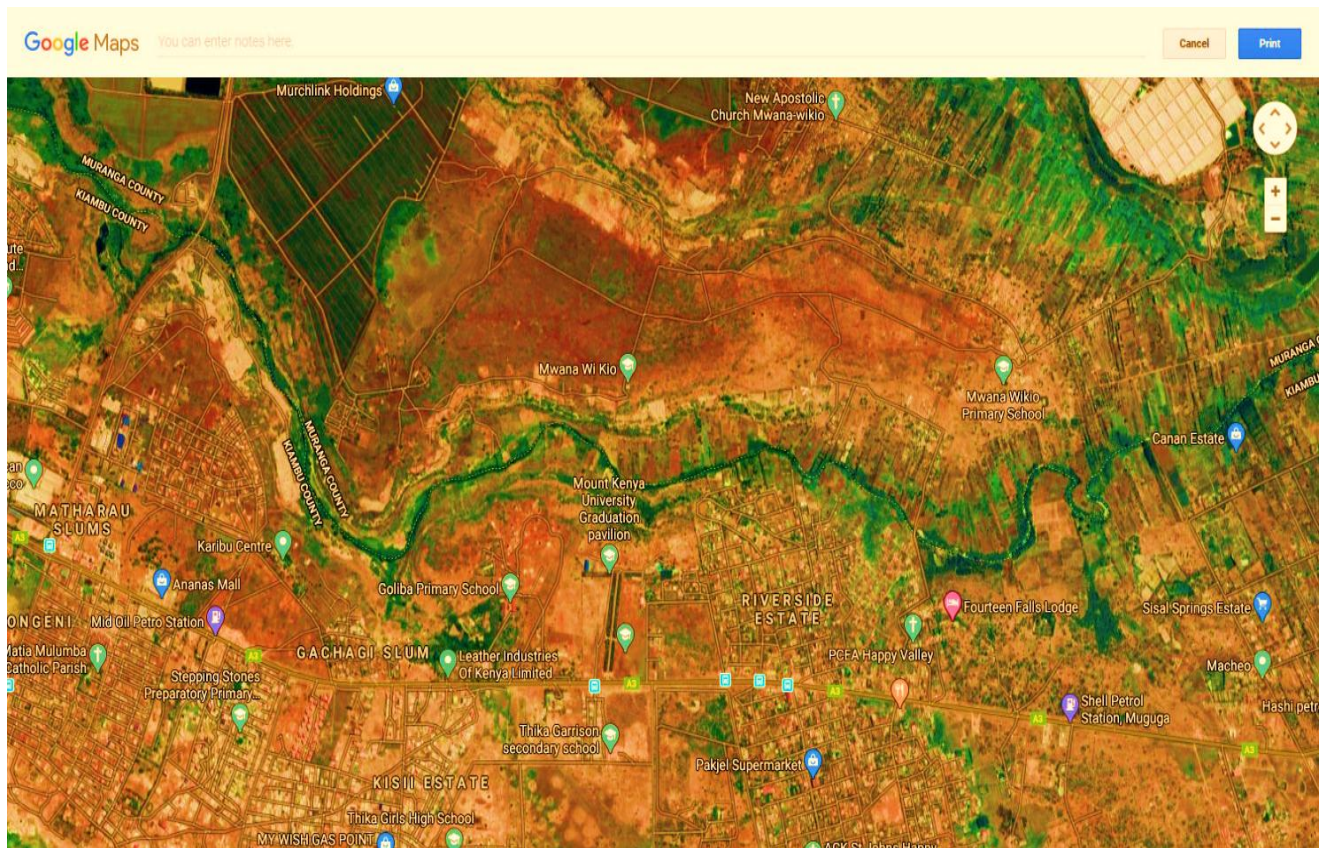
3.4 Location of the Study

The research focused on two main areas namely; Gachagi and Mwanawikio informal settlements which have an approximate population of about 5500 and 81.10 square kilometers in size area. The two named areas are situated near one of the tanneries namely; Leather Industries of Kenya. This is reflected in the maps shown below.

MAP 1: LEATHER INDUSTRIES THIKA, KIAMBU COUNTY



MAP 2: GACHAGI AND MWANAWIKIO THIKA, KIAMBU COUNTY



3.5 Target Population.

The research targeted the operations managers of two tannery industries in Thika Sub-County namely; Leather Industries Limited and Times Unit Industries, but unfortunately the researcher was denied physical access into Times Unit Industries premises despite providing all necessary research permits. The study also targeted the environmental and occupation officers at the County and National level namely; NEMA, Water Resource Management Authority (WARMA), Thika Water Sewage and Company (THIWASCO) In addition the research targeted selected legal environmental experts in the country; United Nations Industrial Development Organization (UNIDO), Kenya Manufactures Association (KMA) and lead activists in Non-Governmental Organizations dealing with environmental issues in the country.

3.6 Research Instruments.

To obtain sufficient and reliable information, the following data collection tools were employed so as acquire data to answer the research questions.

3.6.1 Data Collection Technique

3.6.1.1 The Primary data

Field data from households in the two settlements close to the leather industry was collected by interviews. Key informant interviews and questionnaires collected data from managers of the leather Industries of Kenya and Times Unit Industries Limited, senior officers in the lead institutions that WARMA, NEMA, KEBS, KIRDI, THIWASCO, KLDC County Director of Environment, Kiambu, Chief officer (Water, Energy and Natural Resources), Kiambu, Project coordinator at the Ministry of Environment, water and natural resources, Private stakeholders like UNIDO and KAM as well as Directors of environmental NGO's such as Institute of Culture and Ecology and Hand in Hand Organization.

Samples from tannery effluents were picked from Leather Industries of Kenya but the researcher was denied access to Times Unit leather Industry.

An interview tool was used to collect data from respondents in the Gachagi and Mwanawikio informal settlements in regards to the effects of tannery effluent discharge on their health and socio-economic undertakings.

3.6.1.2 The Secondary data

Data in this category was collected by reviewing; published papers, journals, legislations, documented thesis and dissertations with related relevant researches.

3.8 Data Analysis.

Quantitative data from interviews and questionnaires was analyzed using Statistical Programme for Social Sciences (SPSS) software. Samples from tannery effluents were analyzed at the University of Nairobi Kabete campus (NEMA) certified laboratories by Dr. Nduhiu and Dr. Karanja. The samples effluents were subjected to Atomic Absorption Spectrophotometry for heavy metals and UV Spectroscopy for chromium compounds.

CHAPTER FOUR

ANALYSIS TO THE STUDY

4.0 RESULTS AND FINDINGS.

This Chapter seeks to present analysis of the data collected in answer the three research questions that sought to examine; i) efficacy of regulation on tannery effluent discharge in Thika town ii) barriers that hinder effective enforcement of regulations on tannery effluent discharge in Thika town and, iii) pollution levels of tanneries in Thika town.

Table 1. Social Economic Status of Residents Gachagi and Mwanawikio Informal Settlements in Thika.

Responses by gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	48	71.6	71.6	71.6
	Male	19	28.4	28.4	100.0
	Total	67	100.0	100.0	
Age bracket of respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-25	9	13.4	13.4	13.4
	26-35	16	23.9	23.9	37.3
	36-45	35	52.2	52.2	89.6
	>45	7	10.4	10.4	100.0
	Total	67	100.0	100.0	
Location of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Downstream (Mwanawikio)	22	32.8	32.8	32.8
	Upstream (Gachagi)	45	67.2	67.2	100.0
	Total	67	100.0	100.0	
Occupation of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Casual Worker	11	16.4	16.4	16.4

	Entrepreneur	16	23.9	23.9	40.3
	Farmer	19	28.4	28.4	68.7
	Unemployed	21	31.3	31.3	100.0
	Total	67	100.0	100.0	
Education level of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	College	7	10.4	10.4	10.4
	Primary	44	65.7	65.7	76.1
	Secondary	16	23.9	23.9	100.0
	Total	67	100.0	100.0	
Duration of time lived in the area (Years)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<5	19	28.4	28.4	28.4
	>20	18	26.9	26.9	55.2
	5-10	1	1.5	1.5	56.7
	5-20	29	43.3	43.3	100.0
	Total	67	100.0	100.0	

A total of 67 respondents from Gachagi and Mwanawikio comprising females (71.6%) and males (19%) participated in the study. Majority (52.2%) of the target group were aged between 36 to 45 years. Gachagi settlement had the highest population comprising of approximately 3000 people thus meaning that the sample size for that area was 37 equating to 67.2 % as compared to Mwanawikio village which had a population percentage of 32.8%.

The socio-economic status of the respondents was important in the study in that it helped to give an overview of the respondents. The study revealed that 31.3% of the population in the two areas are unemployed, with most (65.7%) having primary level education. The rest engaged in farming (28.4%), entrepreneurs (23.9%) and 16.4% being casual workers. Majority (43.3%) had lived in the two locales between 5-20 years and had a grasp of the effects of pollution of River Chania and the environs by effluents by Leather Industries of Kenya.

Table 2. Impact of Effluent Discharge on Gachagi and Mwanawikio Informal Settlements in Thika.

Location of Leather industry					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Appropriate	3	4.5	4.5	4.5
	Not appropriate	63	94.0	94.0	98.5
	Not sure	1	1.5	1.5	100.0
	Total	67	100.0	100.0	
Effects of tannery effluent waste and gaseous emissions					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Chest complications	1	1.5	1.5	1.5
	Death of poultry	11	16.4	16.4	17.9
	Destruction of housing roof	7	10.4	10.4	28.4
	Drying of crops	14	20.9	20.9	49.3
	Foul smell	9	13.4	13.4	62.7
	None	10	14.9	14.9	77.6
	Skin irritation	4	6.0	6.0	83.6
	Stomach complications	11	16.4	16.4	100.0
	Total	67	100.0	100.0	
Discharge of leather effluent into river					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less satisfied	24	35.8	35.8	35.8
	Not satisfied	43	64.2	64.2	100.0
	Total	67	100.0	100.0	
Regulations on tannery effluent management					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Effective	7	10.4	10.4	10.4
	Not effective	59	88.1	88.1	98.5
	slightly effective	1	1.5	1.5	100.0
	Total	67	100.0	100.0	

Factors that affect enforcement of effluent waste regulations					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	corruption	25	37.3	37.3	37.3
	impunity of regulators and industries	25	37.3	37.3	74.6
	laxity of regulators	14	20.9	20.9	95.5
	Not sure	3	4.5	4.5	100.0
	Total	67	100.0	100.0	
Mitigations to problems					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Closure of facilities	20	29.9	29.9	29.9
	Filtering of air emissions	9	13.4	13.4	43.3
	Not sure	1	1.5	1.5	44.8
	Relocation of facility	13	19.4	19.4	64.2
	Review of regulations	4	6.0	6.0	70.1
	Treatment of effluent waste	20	29.9	29.9	100.0
	Total	67	100.0	100.0	
Role of county/national government in tannery effluent management					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Involved	5	7.5	7.5	7.5
	Less involved	3	4.5	4.5	11.9
	Not involved	59	88.1	88.1	100.0
	Total	67	100.0	100.0	

From the above table, it is evident that 94% of the 67 respondents were not satisfied with the location of the Leather industry. The study revealed that the Leather Industries of Kenya facility was established in 1982 right in the heart of Gachagi and no engagements were ever made to the residents for the establishment of the same. This means that an Environmental Impact Assessment (EIA) was never done initially. An EIA is a mandatory procedure stipulated under

EMCA for evaluating the likely effects of a proposed activity or project in the environment, thus it provides any information of any negative impacts that would arise in the environment if the activity or project proposed would succeed.

Most importantly is the provision of Section 58 of EMCA which actually obligates the proponent of the activity or project to carry out an EIA at his or her own cost and expense and after the completion of the EIA, a report must be prepared and submitted to NEMA for approval. The same section prohibits the proponent of the project or activity from carrying on any activity that may have a negative impact to the environment.¹²⁹

The point in this case is that the residents of Gachagi and Mwanawikio use the Chania River as their source of livelihood in terms of farming, consumption and other needs. In my view the location of the tannery was not well considered as the Municipal Council at the time did not consider the protection of the natural resources such as the Chania River which has now become a concoction of toxic wastes from the tannery with no government intervention whatsoever despite cries and complains from the residents.

A strategic environment assessment (SEA) is what should have been done to begin with. Reason being that the SEA advocates for development activities in the environment but does not approve any development that would lead to any destruction of any natural resources that would alter the rights of the residents in enjoying the same. Meaning if a proper EIA was conducted none of the pollution evidenced would be present, thus safeguarding the environment.

In the *Gobcikovo Nagymaros*¹³⁰ case, the issue was about a hydro-electric project which no prior EIA study had been conducted and thus it was decided that EIA is mandatory for any state existing activities or for any continuing activity that began from the past.

Thus the Leather Industries of Kenya and the municipality of Thika back then in 1986 should have undertaken an extensive environmental assessment to ascertain any likelihood of negative impacts that the tannery would have caused to the environment. Furthermore, Regulation 42 (1) obligates the lead agencies in consultation with the Authority to subject to all proposals, plans

¹²⁹ Section 58 of EMCA No.5 Of 2015.

¹³⁰ 1997 I.C.J.7, reprinted in 37 I.L.M 162 (1998).

and public policies so as to determine which is environmentally friendly and cost effective to implement.¹³¹

The study established that 16.4% of the residences of Gachagi and Mwanawikio who directly use the waters of River Chania for more than three decades have been suffering greatly of stomach complications. Furthermore the study revealed that 10.4% of the population were affected by toxic and obnoxious fumes emanating from the factories chimneys resulting to corrosion of iron sheets thus destroying the roof, the same gas also causes chest related complications to the residents living near and far from the factories, meaning that the gas fumes can travel to approximately 5 to 7 kilometers away from the factories and again previous studies have shown that this toxic gases can cause cancer related diseases if inhaled for a long period of time.

The study also established that 16.4% of the population complained of death of poultry due to the toxic and obnoxious gases emitted. Further revelation reveal that 20.9% of the population experience drying of crops due to the release of toxic effluent discharged into the. More-so the study established that 64.2% of the population was dissatisfied with the way Leather industry was discharging its hazardous tannery effluents into River Chania with total disregards to the residents.

In regards to EMCA Water Quality Regulations of 2006 which apply to water used for domestic, industrial, agricultural and recreational purposes prohibits discharge of effluent into the environment. The regulations provide for guidelines and standards for discharge of toxic and hazardous pollutants but none of these provisions are adequately enforced. Laxity of the regulations and corruption has enabled these tanneries to continue discharging their effluent waste into public waters.

¹³¹ Regulation 4(1) of the Legal Notice No.101 of the Environmental (Impact Assessment Audit) Regulations 2003

Table 3. List of Regulatory Institutions and Stakeholders Respondents in Tannery Waste Management

Name of Respondent		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	County Govt of Kiambu Chief Officer of Water,Environment and Natural Resources	1	6.3	6.3	6.3
	County Govt of Kiambu Director of Environment	1	6.3	6.3	12.5
	Hand in Hand	1	6.3	6.3	18.8
	Institute of Culture and Ecology	1	6.3	6.3	25.0
	KAM	1	6.3	6.3	31.3
	KEBS	1	6.3	6.3	37.5
	KIRDI	1	6.3	6.3	43.8
	KLDC	1	6.3	6.3	50.0
	Leather Industry of Kenya	1	6.3	6.3	56.3
	Min of Water, Environment and Natural Resources	1	6.3	6.3	62.5
	NEMA	2	12.5	12.5	75.0
	THIWASCO	1	6.3	6.3	81.3
	Times unit Industries	1	6.3	6.3	87.5
	UNIDO	1	6.3	6.3	93.8
	WARMA	1	6.3	6.3	100.0
	Total	16	100.0	100.0	

Location of Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Kiambu	3	18.8	18.8	18.8
	Nairobi	8	50.0	50.0	68.8
	Thika	5	31.3	31.3	100.0
	Total	16	100.0	100.0	

Gender of Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	1	6.3	6.3	6.3
	Male	15	93.8	93.8	100.0
	Total	16	100.0	100.0	

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<45	7	43.8	43.8	43.8
	46-50	3	18.8	18.8	62.5
	>51	6	37.5	37.5	100.0
	Total	16	100.0	100.0	

Occupation of Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Business Relationship Officer	1	6.3	6.3	6.3
	Chief Enforcement Officer	1	6.3	6.3	12.5
	Chief Engineer	1	6.3	6.3	18.8
	Chief Officer Water, Energy and Natural Resources	1	6.3	6.3	25.0
	Chief Technical Manager	1	6.3	6.3	31.3
	County Director of Environment	1	6.3	6.3	37.5
	Director	1	6.3	6.3	43.8
	Director of Leather department	1	6.3	6.3	50.0
	Environmental Officer	1	6.3	6.3	56.3
	Head of Research	1	6.3	6.3	62.5
	Managing Director	1	6.3	6.3	68.8
	Operations manager	1	6.3	6.3	75.0
	Programme Officer	1	6.3	6.3	81.3
	Project Co-coordinator	1	6.3	6.3	87.5
	Project Technical Advisor	1	6.3	6.3	93.8
	Senior Water Quality and Pollution Control Officer	1	6.3	6.3	100.0
Total	16	100.0	100.0		

Educational level of Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	University level	16	100.0	100.0	100.0

Duration of Institution's existence (Years)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Over 20	6	37.5	37.5	37.5
	5 and below	3	18.8	18.8	56.3
	5-20	7	43.8	43.8	100.0
	Total	16	100.0	100.0	

The study examined 16 respondents inclusive of institutions and private stakeholders mandated in the regulatory of tannery waste management. The study area was in Thika town Kiambu County, however some of the respondent's head office were located in Nairobi namely; United Nations Industrial Development Organization (UNIDO), National Environmental Management Authority (NEMA), Kenya Industrial Research Development Institute (KIRDI), Kenya Association of Manufacturers (KAM), Kenya Leather Development Council (KLDC), Kenya Bureau of Standards (KEBS) and Hand in Hand Organization (NGO) which comprised of 50% of the respondents.

The study also examined several respondents in Thika town including Thika Water and Sewage Company (THIWASCO), NEMA Thika, Institute of Culture and Ecology (NGO), Times Unit Industries and Leather Industries Limited which comprised of 31.3% of the respondents.

Furthermore, the study also examined several respondents in Kiambu town namely; County Director of Environment, Chief Officer of Water, Environment and Natural Resources, NEMA and Water Resource Management Authority (WARMA) which comprised of 18.8% of the respondents.

Findings show that 37.5% of the respondents were 51 years and above while 43.8% were 45 years and below, thus suggesting that such positions in those institutions are held by persons with high expertise in industrial waste management.

The study further revealed that 93.8% of the respondents were project technical advisers whose mandate was to act advisory experts to industrialists and the ministry of Environment and Natural Resources on industrial waste management so as to ensure compliance of standards and regulations. More-so 75% of the respondents were operations managers who managed activities of tanning activities.

The study also established that 56.3% of the respondents were environmental officers, meaning that they are highly skilled and trained in environmental management. Findings showed that 25%

included Chief Officer Water, Energy and National Resources, 18.8% included Chief Engineers and lastly 12.5% which included Chief Environmental Officers.

Interestingly, the study revealed that 100% of the respondents were university graduates thus indicating a high level of literacy in the regulatory institutions. Furthermore, the study established that 43.8% of the institutions existed between 5 to 20 years leaving only 37.5% of the institutions to have existed 20 years and above thus suggesting a firm establishment of the same.

Table 4: Role of Regulatory Institutions in Tannery Waste Management

Power to formulate laws					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Absolute	6	37.5	37.5	37.5
	Adequate	2	12.5	12.5	50.0
	Less	1	6.3	6.3	56.3
	None	7	43.8	43.8	100.0
	Total	16	100.0	100.0	
Role of Institution in tannery waste management					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Advocacy and Training	3	18.8	18.8	18.8
	None	2	12.5	12.5	31.3
	Policy Advisory	4	25.0	25.0	56.3
	Regulation and Enforcement	7	43.8	43.8	100.0
	Total	16	100.0	100.0	
Discharge of effluent into river					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not satisfied	14	87.5	87.5	87.5
	Satisfied	2	12.5	12.5	100.0
	Total	16	100.0	100.0	

Regulatory mechanisms used by Institution					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Advocacy and Training	1	6.3	6.3	6.3
	Advocacy and enforcement	1	6.3	6.3	12.5
	Global combat mechanisms	1	6.3	6.3	18.8
	Inspections	2	12.5	12.5	31.3
	Licences	2	12.5	12.5	43.8
	National Legislations	2	12.5	12.5	56.3
	None	4	25.0	25.0	81.3
	Permits	1	6.3	6.3	87.5
	Treatment of waste	2	12.5	12.5	100.0
	Total	16	100.0	100.0	
Regulations on tannery effluent management					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Effective	8	50.0	50.0	50.0
	Not effective	8	50.0	50.0	100.0
	Total	16	100.0	100.0	
Legal Framework adopted by Institution					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	National legislation	10	62.5	62.5	62.5
	None	6	37.5	37.5	100.0
	Total	16	100.0	100.0	
Monitoring Inspections and Safety tests					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Annually	6	37.5	37.5	37.5
	Monthly	1	6.3	6.3	43.8
	None	7	43.8	43.8	87.5
	Quarterly	2	12.5	12.5	100.0
	Total	16	100.0	100.0	

From the above tables, the study revealed that 37.5% of the respondents had absolute powers to formulate laws for regulating tannery waste while 12.5% of the respondents had only adequate powers to do so, but with guidance of the lead institutions. A good example is the Ministry of Environment and Natural Resources which formulate policy and laws which are enforced by NEMA and WARMA.

Findings showed that 43.8% of the respondents engaged in regulation and enforcement such as NEMA and WARMA which regulate and enforce regulations on environmental protection and conservation. However, 25% of the respondents engage in policy advisory on tannery waste management, a good example including; KLDC, KAM and UNIDO who act as advisors to the ministry as well as the industries in managing effluent waste and using enhanced technology in the treatment of the waste so as to maintain sustainability.

The study also revealed that 18.8% of the respondents engage in advocacy and training on industrial waste management. A good example is the Ministry and the NGO's. Findings showed that 31.3% of the regulatory mechanisms used by the respondents include; inspections which are usually done annually as 37.5% of the respondents admit to that. The purpose of inspections is to ensure that standards and compliance are adhered and failure to which legal actions is taken against the industrialists.

The study established that 64.2% of the residence of Gachagi and Mwanawikio were not satisfied with the way Leather industry facility was discharging its effluent into Chania River and no legal action taken up-to date and further endangering the health of the residents.

Finding revealed that 50% of the respondents regarded the regulations on tannery effluent management to be ineffectual while 50% of the respondents regard the same to be effective. Further indicating that 20.9% of the residents of Gachagi and Mwanawikio were of the opinion that the National and County institutions mandated to regulate tannery effluent discharge are reluctant to make adequate inspections to ensure compliance with standards.

Furthermore, the study established that 62.5% of the respondents rely on the national legislations on tannery waste management while 37.5% of the respondents had none.

4.1 Barriers to the Enforcement of Hazardous Waste Regulation in the Leather Industries in Thika, Kiambu County.

Table 5. Barriers to Effective Enforcement of Hazardous Waste Regulations in the Leather Industries in Thika, Kiambu County.

Barriers to enforcement					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Impunity and corruption of industrialists	3	18.8	18.8	18.8
	Impunity and corruption of industries	1	6.3	6.3	25.0
	Inadequate funds	3	18.8	18.8	43.8
	Inadequate policies	2	12.5	12.5	56.3
	Inadequate treatment facilities	4	25.0	25.0	81.3
	Inferior knowledge in waste treatment	2	12.5	12.5	93.8
	Overlapping laws on waste regulation	1	6.3	6.3	100.0
	Total	16	100.0	100.0	

From the above table, the study revealed that 18.8% of the respondents were of the opinion that impunity and corruption of industrialists has made enforcement a big problem, reason being that the same industries that don't want to comply to standards and regulation opt to bribe regulatory enforcement officers so as to continue with their illegal discharge of toxic and harmful effluents into the rivers.

The study revealed that 88.1% of the population was not satisfied with the current regulations and institutions that are mandated to regulate on effluent discharge of hazardous waste in public waters. To understand this response one has to look at the main institutions mandated to regulate effluent discharge in public waters their core functions in enforcement and more-so what constraints they experience in the enforcements of this regulations.

Implementation and enforcement of hazardous waste laws in retrospect means the work and role of government institutions mandated to implement and enforce the pollution control laws which provide guidelines on discharge of effluents into public waters and also ensures adherence to the same laws so as to prevent any degradation of any natural resource in the environment

In evidence to the above, Dr.Nduhiu Gitahi, Principal Technologist at the University of Nairobi, department of public health stated in his findings in the Daily Nation dated 15th August 2019¹³², that NEMA which is the principal body mandated to oversee all issues pertaining to the environment, an example of Nairobi river which contains very high levels of deadly metals and bacteria which renders it unfit for human consumption and use, more-so the same river feeds River Athi which again will be harvested in the yet to complete Thwake Dam which upon completion will open doors to very toxic waters as a result of pollution which NEMA has been silent as all these industries involved in this pollution have been authorized to carry out their activities by NEMA yet no revocation of the same licenses was ever made.

Findings reveal that 18.8% of the respondents admit that the lead institutions have inadequate funds to enable them enforce regulations. The study revealed that these institutions such as WARMA and NEMA lack resources for modern equipment, and technology to enable compliancy and as a regulator for administration. The lead agencies lack basic requirements such as serviced motor vehicles, computers and stationery. Data collection and analysis is constrained for lack of analyses' facilities such as laboratories and trained staff. For instance the government chemists are overwhelmed by the number of specimens awaiting analyses that are received from ill disciplines enquiry. This takes too long to get critical information.

The study also revealed that 37.5% of the respondents were of the opinion that tanneries use dated technology in treating effluent waste before discharging it into the environment. Very few

¹³² <https://www.nation.co.ke> accessed on 15th August 2019.

tanneries have advanced treatment facilities for treating the same. In regards to waste management, NEMA is supposed to give information to the regulated facilities on technologies for sound disposal of chemicals and hazardous wastes. The inspectors need be everywhere with the necessary technology and a good number of laboratories that would give results and reports necessary for prosecutions. This is judging from the responsibilities assigned to it under the Act, the implementations of the Act, the enforcement machinery and the direct supervision of all the lead agencies and coordination's for policy making.

Findings reveal that 12.5% of the respondents were of the opinion that lack of adequate policies and laws on tannery effluent management has resulted to overlapping laws on the same. A good example is Kiambu county government which uses the Kiambu County Government Water and Sanitation Act which provides for water resource management and sanitation to regulate on pollution, soil and water conservation as well as sustainable management of water resources.¹³³

The study also revealed that this county regulation only provides for compliance of effluent discharge into water resources and penalties for non-compliance of the same. Similarly provisions of section 43 and 46¹³⁴ of this Act are similar to the provisions of section 93 and 142 of EMCA, which lack to give proper guidelines on how tanneries are to dispose their harmful effluents into water resources

The study further revealed that overlapping of tannery effluent law and regulations, from sector specific laws to new regulations procedures and requirements under EMCA. Most of the regulations under EMCA have not been formulated; the lead agencies are still applying the old environmental laws that are sector specific. For enforcement, this means that the old penalties are still applied in the case of prosecutions which are still under the old offences in the penal code. Only a few statutes have been repealed such as the water act, parts of the local government act, and the physical planning act.

Even then the new water act is yet to be implemented as it is undergoing the transition period and most regulations not formulated as some, such as the water quality standards and effluent discharge standards are dependent on the implementations under EMCA. This means that for

¹³³ KIAMBU COUNTY GOVERNMENT Water and Sanitation Act No.2A of 2015.

¹³⁴ KIAMBU COUNTY GOVERNMENT Water and Sanitation Act No.2A of 2015.

water pollution for instance, despite the new penalties, cannot be applied until the water standards have been gazetted for application and enforcement.

The other constraint is lack of resources to retraining their staff on chemical and waste management to reorient them to the new environmental management law. The training for staff is necessary as the lead agencies are a regulated community, engaged in many projects, activities and programmes that need undergo EIAs and be monitored.

The lead agencies face the risk of being sued for non-compliance to the law. The training of staff is necessary also because the lead agencies need own the environmental law as they are engaged in day to day activities that have a bearing on environmental degradation. This will also make them appreciate the mandate given to NEMA in -the implementation and enforcement, and will ease the task of NEMA on supervisions and co-ordinations with the lead agencies.

NEMA which is the predominant instrument of the Government of Kenya in the implementation of all insurance policies bearing on to the environment exercising generic supervision and coordination over all things on environment. However NEMA cannot grant facts on chemicals in the surroundings inclusive of waste. This is due to the fact that monitoring is a problem due to the fact of lack of analytical capacity and depends on other institutions presenting it with information. This is no longer always impending as there is no criminal basis for different establishments to furnish it with information.

Again in regards to NEMA, the Chemicals section falls a ways beneath the administration hierarchy implying that the trouble has no longer been of priority in this institution. Also does not appear to be synergies between the Chemical section and that on Waste management.

More-so the NEMA has nonetheless no longer been capable to provide leadership and preparation on education or attention rising on sound chemical lifestyles cycle and waste administration due to few human assets and financial constraints. Again NEMA lacks enough skilled personnel on waste administration and for monitoring of industrial things to do in view of stopping pollution in water resources.

The Kiambu County Government does not run information and training programs on sound chemical or waste management for industrial facilities. There is also no formal platform for information communication between lead agencies and the County Government. In addition,

there is absence of reliable and accurate information on hazardous and toxic waste disposal thus enabling industrial facilities to increase their pollution in the natural water resources.

Table 6: Results for Tannery Effluent Discharge Samples from river Chania.

HEAVY METALS PARAMETERS IN ppb				
Sample ID	Lithium (Li)	Beryllium (Be)	Vanadium (V)	Chromium (Cr)
Gachagi	1.0	0.4	ND	0.1
Leather ind.LTD	2.7	0.4	1.0	37.5
Mwanawikio	ND	0.2	0.5	ND

***Note: ND=Not Detected. *Regulation (EC) No 98/83: MRLs for all the analysed heavy metals i.e.**

As=0.01ppb,Cd=0.005

ppb,Al=0.2ppb,Fe=0.2ppb,B=1.00ppb,Cr=0.05ppb,Mn=0.05ppb,Na=200ppb,Se=0.01ppb,Cu=2.0 ppb,Pb=0.01ppb.

HEAVY METALS PARAMETERS IN ppb								
Sample ID	Manganese (Mn)	Cobalt (Co)	Nickel (Ni)	Gallium (Ga)	Arsenic (As)	Selenium (Se)	Rubidium (Rb)	Strontium (Sr)
Gachagi	ND	ND	2.5	ND	0.3	ND	11.7	97.8
Leather	1549.5	3.1	2.9	ND	0.9	ND	48.2	334.7
Mwanawikio	19.5	ND	2.3	ND	0.3	ND	10.8	82.0

***Note: ND=Not Detected. *Regulation (EC) No 98/83: MRLs for all the analysed heavy metals i.e.**

As=0.01ppb,Cd=0.005

ppb,Al=0.2ppb,Fe=0.2ppb,B=1.00ppb,Cr=0.05ppb,Mn=0.05ppb,Na=200ppb,Se=0.01ppb,Cu=2.0 ppb,Pb=0.01ppb.

HEAVY METALS PARAMETERS IN ppb											
Sample ID	Silver (Ag)	Cadmium (Cd)	Caesium (Cs)	Barium (Ba)	Thallium (Tl)	Lead (206 Pb)	Lead (207 Pb)	Lead (208 Pb)	Bismuth (Bi)	Thorium (Th)	Uranium (U)
Gachagi	ND	ND	ND	41.3	1.7	ND	ND	ND	1.7	1.4	1.5
Leather ind	ND	ND	ND	49.9	1.8	ND	ND	ND	1.7	1.5	16.9
Mwanawikio	ND	ND	ND	24.4	1.7	ND	ND	ND	1.7	1.4	1.5

***Note: ND=Not Detected. *Regulation (EC) No 98/83: MRLs for all the analysed heavy metals i.e. As=0.01ppb,Cd=0.005 ppb,Al=0.2ppb,Fe=0.2ppb,B=1.00ppb,Cr=0.05ppb,Mn=0.05ppb,Na=200ppb,Se=0.01ppb,Cu=2.0 ppb,Pb=0.01ppb.**

From the above results it is very evident that River Chania is heavily polluted with heavy metals which emanate from the Leather Industries limited. Looking at the effluent discharge from the Leather Industry, one can be able to see the high levels of Chromium residues of 37.5ppb which is extremely higher than the required amount of 0.05 ppb as per the Water Quality Regulation of 2006 third schedule. More-so Manganese residues in the Leather Industries effluent discharge was 1549.5ppb while for Mwanawikio area was 19.5ppb, way above the maximum allowed quantity by the Water Quality Regulations of 2006 that allows only a maximum of 0.05ppb. Similarly, high concentrations of Arsenic residues are also present where Gachagi and Mwanawikio area having 0.3ppb and Leather Industry effluent discharging 0.9ppb again higher than the 0.01ppb prescribed by the Water Quality Regulations of 2006.

Higher concentrations of heavy metals in the rivers are carcinogenic as it increases rates of people getting cancer related diseases. This now confirms that NEMA and the County Government of Kiambu do not carry out adequate inspections more in particular Section 53(1) of the Water and Sanitation Act which authorizes county enforcement officers to carry out adequate inspections in industrial premises so as to ensure compliance of effluent discharge regulations.¹³⁵ Failure of this has resulted to reckless discharge of hazardous effluents into natural water resources. According to a similar study conducted by Dr. Nduhiu Gitahi, principal technologist at the department of public health, university, water samples collected from Thwake dam in

¹³⁵ KIAMBU COUNTY GOVERNMENT Water and Sanitation Act, No.2A of 2015, section 53(1).

Makueni as well as Nairobi River and Ngong River had high levels of aluminum, manganese, barium and iron heavy metals which if they are ingested may increase the chances of suffering from cancers, respiratory diseases, stomach alignments as well as skin diseases.¹³⁶ But shockingly is that the regulators such as NEMA are the same people who give polluters a clean bill of health despite the dangerous chemicals flowing into the rivers. Section 108 of the Water Act provides for the industry to acquire a license from the lead regulator which is NEMA to discharge any effluent into any water resource. Section 36 of the Water Act mandates or authorizes lead regulator to issue a license to any industry purporting to discharge any effluent into any water resource.

TABLE 7: Results for Chromium Compounds in Tannery Effluent from the Leather Industry Treatment Discharge point.

LOCATION	COD (mg/l)	BOD (mg/l)	Cr (mg/l)	Cr (VI) (mg/l)
Gachagi	33.12	4.50	0.014	ND
Mwanawikio	32.08	5.00	0.015	ND
Leather Industry Ltd	45.00	8.00	0.080	0.02

According to some response from members of Gachagi and Mwanawikio, the study revealed that the Leather Industries Limited have perfected their mode of discharging in view of tricking the regulators such as NEMA. Initially they would discharge their effluent into the river in the morning and afternoon hours, but now they discharge the same at night from around 7pm until mid-night thus by morning hours no alarming traces of the chromium (VI) chromium residues can be found in the river. Thus I can conclude by saying that NEMA and the County Government of Kiambu have been laxing when it comes to regulate the activities of tanneries in Thika industrial area thus allowing the tanneries to discharge hazardous effluents into River Chania and consequently endangering the lives of thousands of Thika residents.

¹³⁶ <http://www.nation.co.ke> accessed on August 15th 2019.

CHAPTER FIVE

5.0 FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

5.1 Summary of Findings

Findings of the study revealed barriers to the enforcement of hazardous waste in the leather industry as; inadequate funds for enforcement agencies, lack of synergies on chemical section and waste management under NEMA, inadequate treatment facilities for effluent waste, inferior knowledge on waste treatment, overlapping laws and regulations on tannery effluent waste management , inadequate training for lead agencies staff on chemical and waste management, impunity and corruption of leather industries in discharging harmful effluents into the environment.

5.2 Conclusions

The following determinations were made in view of the findings;

- a) Pollution levels derived from post-treatment samples clearly indicate that they are well above the requirements of the Water Quality Regulations, 2006 under the Third Schedule of the Effluent Release Guidelines. The provisions of Article 42, 69 and 70 of the Kenyan Constitution, which provides for the right to clean and healthy environment for every citizen as well as the primary responsibility of the state and individual citizen to assure that the environment is clean and safe is not upheld in this instance. Similarly, Article 36 of the Water Law, which prohibits the discharge of any contaminated effluent into a water resource, has not yet been maintained by the tanneries of the Thika industrial area.
- b) On the basis of the results obtained, it is clear that the NEMA regulations for the tanning industry are just as stringent. Consequently, the pollution load from tanneries is still heavy and therefore a problem for both residents living in the river's interior and for aquatic life in the Chania River.
- c) Results, impunity and corruption of the agents of authority and management of the tannery industries allowed the tanneries to discharge with confidence the harmful effluent into the Chania River in total ignorance of the regulation. The issuing of bribes to the judicial officers of the National Institutions and the County has made it impossible to conduct inspections and security tests, thus encouraging the same tanneries to continue to decrease the quality of the receiving environment.

- d) The lack of competent training of waste enforcement officers has led to the application of similar approaches to the regulation of tanning operations, contributing to the increasing destruction of natural water resources, more specifically, the river Chania.
- e) Thika tanneries do not use conventional systems to treat all product effluent mixtures. Due to the high cost of treatment facilities, no efficient treatment is performed. Such a disastrous approach renders compliance with environmental rules impossible.
- f) The results also show overlapping of regulations on tannery effluent discharge has led to tanneries in Thika taking advantage of the inconsistency of the provisions under Section 108 and 36 of the Water Act 2016 which allows industries to discharge effluent in water resource by issuance of permits/licenses, but again under Section 93(1) and 141(f) of EMCA which prohibits discharging of any effluents containing any pollutants into any water resource. As a result of this regulatory inconsistency, tanneries confidently released harmful effluents without taking the necessary precautions to protect and conserve the environment.
- g) Few inspections of tannery activities, as well as the conduct of safety tests in tanneries, are critical to determining compliance with standards and regulations to control violations. The results have shown that only one inspection is carried out once a year in tanneries, which allows for unsupervised production activities, leading to increasing pollution of the Chania River.
- h) Insufficient funding from NEMA for the regulation of systems for monitoring effluent discharges from tanneries in Thika, such as funding the setting up of advanced laboratories for the analysis of chemical samples of tannery effluents, has hindered the application of regulations on tanning activities.

5.3 Recommendations

The study makes the following recommendations to mitigate the cited barriers;

- a) The revision of Sec 108, 36 of the Water Act 2016 and Section 93(1) and 141(f) of EMCA 2019 to consider permanent banning of effluent discharge into water resources.
- b) The leather industries should adopt technological environmental innovations so as to come up with better and safer ways of leather production more-so on chemical recovery and reuse which is an economical feasible alternative for the leather sector and has a

short payback period which should all be driven to meet compliance and thus achieve sustainable production and consumption.

- c) The lead enforcement institutions both National and County need to carry out quarterly inspections other than the stipulated annual inspections so as to monitor effluent discharge of tanneries.
- d) Both National and County enforcement officers should have quarterly training on industrial waste management so as to have a proficient understanding on technology used in tanning process as well as discharge of effluent.
- e) Adequate funding by the National government should be given for NEMA's development pointers which would enable setting up of modern equipped laboratories in every county so as to facilitate sound management of chemicals and waste administration for safe disposal of dated chemical compounds and hazardous wastes.
- f) The National government should create incentives for leather industries by reducing taxation on importation of equipment for pollution control work.
- g) Revision of Section 72, 93(3) and 142(1) of EMCA 2019 in making the penalties more hefty in view of deterring leather industries from discharging harmful effluents into rivers and as well bear the cost of cleaning the environment in the course of polluting the water resources.

5.4 Recommendation for Further Research.

More research should be done on tannery effluent disposal more-so the methodology applicable to reduce pollution from chemical waste so as to strive for superior environmental performance and not affect the quality of the receiving environment.

BIBLIOGRAPHY.

BOOKS:

1. Baker, *Sustainable development* (Routledge introductions to the environmental series). (2006), London: Routledge publisher, p. 20.
2. Bechtold T., Eduard Burtscher E. & Hung Yung-Tse. (2006). *Treatment of Textile Wastes*. In: Lawrence K. Wang, Yung-Tse Hung, Howard H. Lo & Constantine Yapijakis (eds), (2009). *Waste Treatment in the Process Industries*. New York: CRC Press, pp. 363-398.
3. Cunningham, N., *Environment Law, regulation and governance: shifting architectures*, (2009), J. Env. L. 179, pp. 1-25.
4. John O'Neill. *Markets, Deliberation and Environment*, (2007), Routledge, USA: New York, p. 101.
5. Magraw and Hawke: *Sustainable development*, in the *Oxford Handbook of International Environmental Law*, (2007) New York: Oxford University Press, p. 637.
6. Marquette K. Hill, *Understanding Environmental Pollution*, Cambridge University Press, (2010), p.10.
7. Neil Carter, *The politics of the environment-ideas, activism and policy* (2nd edn.), (2007) Cambridge University Press: UK, p. 208.
8. Wang L.K. & Aulenbach, D.B: *Implementation of Industrial Ecology of Industrial Hazardous Waste Management*, (2006). In: Lawrence K. Wang, L.K., Hung, Y., Lo, H.H., & Yapijakis, C., (Eds), (2009). *Waste Treatment in the Metal Manufacturing, Forming, Coating, and Finishing Industries*. New York: CRC Press, pp. 1-13.

JOURNALS:

9. Amechi, E. *Linking environmental protection and poverty reduction in Africa. An analysis of the regional legal responses to environmental protection.* (2010) 6,112-129. Law, Environment Development Journal.
10. Nduta R.W., Shisia, A., Kamau, G. and Asienga, I., “Challenges Facing Public Resources Management of Developed Governments in Kenya: A case of Machakos County.” *International Journal of Economics Commerce and Management*, Vol V, Issue 9, September 2017.
11. Final Report of the Task force on Devolved Government, Vol I (Office of the Deputy Prime Minister and Ministry of Local Government, (Government Printer, Nairobi 2011).
12. Chitere, P., Chweya, L., Masya, J., Tostensen, A. and Waiganjo, K., ‘Kenya Constitutional Document: A Comparative Analysis, CMI Reports, 2006. Available at <http://www.cmi.no/publications/file/2367-Kenya-constitutional-documents.pdf> (Accessed on 5//11/2020).
13. Nduta R.W., Shisia, A., Kamau, G. and Asienga, I., “Challenges Facing Public Resources Management of Developed Governments in Kenya: A case of Machakos County.” *International Journal of Economics Commerce and Management*, Vol V, Issue 9, September 2017.
14. Chitere, P., Chweya, L., Masya, J., Tostensen, A. and Waiganjo, K., ‘Kenya Constitutional Document: A Comparative Analysis, CMI Reports, 2006. Available at <http://www.cmi.no/publications/file/2367-Kenya-constitutional-documents.pdf> (Accessed on 5//11/2020).
15. Juma T., Rotich J. and Mulongo, L, “Devolution and Governance Conflicts in Africa: Kenyan Scenario, “Public Policy and Administration Research, Vol, 4 No 6 2014, p.4.
16. Belay, A. Alebel: *‘Impacts of Chromium from Tannery Effluent and Evaluation of Alternative Treatment Options.’* (2010) *Journal of Environmental Protection*, 4-5.
17. Bosek, J. K: *Implementing environmental rights in Kenya's new constitutional order: Prospects and potential challenges.* *African Human Rights Law Journal*, (2014), 14(2), 489-508.

18. Braunig, W.A., *Reflexive law solutions for factory farm pollution*, (2005), N.Y.U.L Rev., Vol. 80, pp.1505-1548.
19. Chakraborty C, H. M: *Analysis of the Causes and Impacts of Water Pollution of Buriganga River*: (2013). A Critical Study. INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 2, 2, 6.
20. Chakraborty, P: *Environmental Standard and Trade- Evidence from Indian Textile & Leather Industry*, (2011), Ph. D Thesis, Graduate Institute, Geneva.
21. Chowdhury, M., Mostafa, M., Biswas, T. K., & Saha, A. K.: *Treatment of leather industrial effluents by filtration and coagulation processes*. (2013), Science Direct, 1-2.
22. Dima W. Nazer, R. M.-S: *Reducing the environmental impact of the unhairing/liming process in the leather tanning industry*. Journal of Cleaner Production 14 (2006), 1.
23. M. R. Azom, K. M: *Environmental Impact Assessment of Tanneries: A Case Study of Hazaribag in Bangladesh*. Universal Journal of Environmental Science and Development, (2012). Vol. 3, No. 2, 3, 4.
24. Muniafu and Otiato, E: *Solid Waste Management in Nairobi, Kenya*. A Case for rising economies. The Journal of Language, Technology and Entrepreneurship in Africa, (2010), p342-350.
25. UNEP, *Waste crime - Waste risks. Gaps in meeting the global waste challenge* (United Nations Environment Programme and GRID-Arendal, 2015)
26. Verschuuren, *Sustainable Development and the Nature of Environmental Legal Principles*. Potchefstroom Electronic Law Journal, Vol. 9, No. 1, 2006, p.52. Available at SSRN: <http://ssrn.com/abstract=899537> (Accessed on November 2, 2018).

WEBSITES:

27. Fred Pearce, 2012. Beyond Rio, green economics can give us hope. The Guardian; <http://www.guardian.co.uk/environment/series/guardian-environment-network> (Accessed on November 2, 2018).
28. Glorious Sky Foundation. (2015, April 22). ENVIRONMENTAL AND HEALTH EFFECTS OF TANNERY WASTES PRODUCED FROM HAZARYBAGH AREA. Retrieved September 2, 2018, from Glorious Sky Foundation (GSF): <http://gsfoundation.info/environmentaland-health-effects-of-tannery-wastes-produced-from-hazarybagh-area/>
29. Robinson Marc 2012."Preface", in OECD, Development Cooperation Report 2012: Lessons in Linking Sustainability and Development, OECD Publishing. Available at; <http://dx.doi.org/10.1787/dcr-2012-5-en> (Accessed on November, 2, 2018).

NATIONAL LEGISLATION:

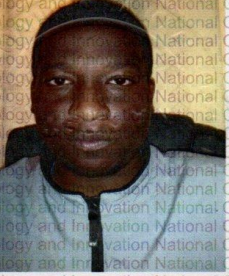
30. ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT (1999) Revised EDITION No. 18 of 2018, L.N 31 OF 2019.
31. ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT (1999), (WASTE MANAGEMENT REGULATION) 2006.
32. ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT (1999), (WATER QUALITY REGULATION) 2006.
33. HEALTH ACT (AMENDED) NO. 5 OF 2019
34. HIDES, SKIN AND LEATHER ACT No. 17 of 2006.
35. THE CONSTITUTION OF KENYA (2010).
36. WATER ACT No. 43 of 2016.

CASE LAW:

37. Agricultural Excess & Suplus Inc. Co. V. A.B.D. Tank & Pump Co; 878 F. SUPP. 1091, 1096 (N.D. III. 1995).
38. Gobcikovo Nagymaros 1997 I.CJ.7, reprinted in 37 I.L.M 162 (1998).
39. Indian Council for Enviro Legal Action v Union of India (1996) 2JT 196: (1996 AIRSCW 1069).
40. K.M & 9 others v Attorney General & 7 Others Petition No. 1 of (2016).
41. Benson Ambuti Adeg & 2 Others v Kibos Sugar and Allied Industries Limited & 4 Others Petition No. 8 of (2018).
42. Peter K. Waweru (2006) eKLR


**5.5: APENDIX 1
RESEARCH PERMIT**

THIS IS TO CERTIFY THAT: **Permit No. : NACOSTI/P/19/33826/29332**
MR. ERIC WAMBUGU WANGO **Date Of Issue : 30th April,2019**
of UNIVERSITY OF NAIROBI, 0-100 K.U **Fee Received :Ksh 1000**
NAIROBI,has been permitted to conduct
research in *Kiambu County*
on the topic: *ANALYSIS OF BARRIERS*
TO THE ENFORCEMENT OF HAZARDOUS
WASTE REGULATIONS IN THE LEATHER
INDUSTRY: A CASE STUDY OF THIKA
INDUSTRIAL AREA KIAMBU COUNTY,
KENYA.
for the period ending:
30th April,2020



Applicant's Signature **Director General**
National Commission for Science, Technology & Innovation

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013
The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.



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National Commission for Science, Technology and Innovation
RESEARCH LICENSE

CONDITIONS

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
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4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
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Serial No.A 24399
CONDITIONS: see back page

QUESTIONNAIRES FOR INDUSTRIES/FIRMS.

SECTION ONE. (Fill the spaces and tick on boxes provided).

1. Name of the industry/company?

2. Location of the industry/company?

3. Name of the chief officer in-charge of the company's operation?

4. Occupation of the chief officer in-charge in the company?

5. Age of the chief officer in-charge?

- a) 25-30 years () b) 30-35 years () c) 35-40 years d) 40-45 years e) 45-50 years () f) 50-55years () g) 55-60 years () h) 60 years and above.

SECTION TWO. (Fill the spaces and tick on boxes provided).

6. For how long has the firm/industry been in existence?

- a) 0-5 years () b) 5-10 years () c) 10-15 years () d) 15-20 years () e) 20-25 years f) 25-30 years g) 30 years and above.

7. What are the main activities carried out by the firm/industry?

8. In regards to the location of the industry was an EIA done?

- a) Yes () b) No () c) Not sure ().

9. Is the firms EIA license subject to NEMA revisions?

- a) Yes () b) No () c) Not sure ().

10. What kind of chemicals are used by your firm during the tanning process?

11. Where does the firm discharge its tannery effluent during tanning process?

12. Where does the firm acquire its license and permit for effluent discharge into water resources?

13. How are waste effluent discharged during tanning process?

14. What are the major constituents of waste effluent discharged?

15. Are there any regulatory mechanisms employed by the firm in controlling discharge of effluents into the environment?

16. What are the current legal frameworks employed by the firm/industry in effecting enforcement of regulations on tannery effluent management?

17. Does your firm carry out safety tests of effluents before discharging into the environment?

a) Weekly () b) Monthly () c) Quarterly () d) Annually ().

18. Are you involved with the County in deliberating tannery effluent discharge issues?

a) Less involved () b) much involved () c) Not involved ().

19. What is the role of County in the enforcement of tannery effluent regulation?

20. What are some of the challenges you encounter in the enforcement of regulations on tannery effluent management?

21. Are the NEMA and County Government standard industrial effluent control provisions applicable to your firm?

a) Less applicable () b) strongly applicable () c) Not applicable ().

QUESTIONNAIRES FOR NGO'S.

SECTION ONE. (Fill the spaces and tick on boxes provided).

1. Name of the NGO?

2. Location of the NGO headquarters?

3. Name of the chief officer in-charge of the NGO?

4. Occupation of the chief officer in-charge NGO?

5. Age of the chief officer in-charge?
b) 25-30 years () b) 30-35 years () c) 35-40 years d) 40-45 years e) 45-50 years () f) 50-55years () g) 55-60 years () h) 60 years and above.

SECTION TWO. (Fill the spaces and tick on boxes provided).

6. How long has your organization been existence since it first commenced with its activities?
a) 0-5 years () b) 5-10 years () c) 10-15 years () d) 15-20 years () e) 20-25 years f) 25-30 years g) 30 years and above.
7. What are the main responsibilities obligated to your organization?

8. Which organization is responsible for highlighting effects of tannery effluent pollution in Thika?

9. Does your organization hold enough power to formulate rules, laws or policies pertaining to tannery effluent management in Thika sub-county, Kiambu County?
a) Less () b) Adequate () c) Absolute () d) None ().
10. Which stakeholders do you partner with in effecting tannery waste management regulation and policies?

11. What assistance do you offer to your partners?

12. What achievement, has your organization attained in the County since it was established?

13. What are the major problems in the enforcement of tannery effluent regulation in the County and who is responsible?

14. How can these problems be eliminated and what do you recommend?

15. In your recommendation what role and effort will your organization put in place?

16. Are there any regulatory mechanisms employed by the County government of Kiambu in controlling tannery effluent discharge in Thika?

17. What are the current legal framework in place that ensure effective enforcement of regulations on tannery waste management in Thika, Kiambu County?

QUESTIONNAIRE FOR COUNTY ENVIRONMENTAL DIRECTOR.

SECTION ONE. (Fill on spaces and tick on boxes provided).

1. Name of the County Environmental Department?

2. Location of the Department's headquarters?

3. Name of the chief officer in-charge of County environmental operations?

4. Occupation of the chief officer in-charge County Environmental operations?

5. Age of the chief officer in-charge?
c) 25-30 years () b) 30-35 years () c) 35-40 years d) 40-45 years e) 45-50 years () f) 50-55years () g) 55-60 years () h) 60 years and above.

SECTION TWO (Fill the space and tick on boxes provided).

6. Does your ministry department hold enough power to formulate rules, laws or policies pertaining to tannery effluent management in Thika sub-county, Kiambu County?
a) Less () b) Adequate () c) Absolute () d) None ().
7. What are the regulatory mechanisms employed by your ministry department in controlling tannery effluent discharge in Thika, Kiambu county?

8. Are monitoring inspections conducted in tanneries? And by who? After how long?

9. What is the importance of monitoring inspections in tannery industries?

10. Are there any guidelines on tannery effluent discharge in the County?

11. Does the County issue permits to industries for discharging effluents into water bodies? If yes, are there guidelines for renewal of the permits?

12. What are the main challenges that hinder effective enforcement of tannery effluent regulations?

13. What are the current legal frameworks adopted by your ministry department in enforcement of regulations on tannery waste management in Thika, Kiambu county?

14. How do you deal with this challenges and what do you think could be done?

15. How do you co-operate with NGO's and other stakeholders in tannery waste management?

QUESTIONNAIRE FOR HOUSEHOLD.

SECTION ONE. (Fill the spaces and tick the boxes provided)

1. Name of the respondent?

2. Age of the respondent?

a) 10-15 years () b) 15-20 years () c) 20-25 years () d) 25-30 years () e) 30-35 years () f) 35-40 years () g) 40-45 years () h) 45-50 years () i) 50 years and above ().

3. Occupation of the respondent?

4. How many members of family do you have?

5. For how long have you stayed in Thika?

a) 0-5 years () b) 5-10 years () c) 10-15 years () d) 15-20 years () e) 20-25 years () f) 25-30 years () g) 30-35 years () h) 35-40 years () i) 40 years and above ().

SECTION TWO. (Fill the spaces and tick the boxes provided.)

6. Does the Leather industry affect you? How does it affect people in the neighborhood of the industry?

7. Do you think the Leather industry is located in the right area? If NO what is your reason?

8. Are you satisfied with the way the Leather industry discharges its effluent into the water resources? What are some of the recommendations you would suggest?

a) Less satisfied () b) Satisfied () c) Very satisfied () d) Not satisfied ().

9. Do you think the regulations on tannery effluent management are efficient? What reforms do you suggest should be put in place?

- a) Less efficient () b) Efficient () c) More efficient () d) Not efficient ().

10. In your own opinion what are some of the factors that affect the enforcement of regulations on tannery effluent discharge in Thika, Kiambu County?

11. Do you know of any regulations in place that help regulate tannery effluent discharge?

12. Do you think the county has played its role in reducing water pollution from tannery effluent discharge?

- a) Satisfied () b) Very satisfied () c) Not satisfied () d) Not sure ().

QUESTIONNAIRE FOR CABINET SECRETARY FOR ENVIRONMENT AND WATER RESOURCES.

SECTION ONE. (Fill the spaces and tick on boxes provided).

1. Name of the Ministry?

2. Location of the Ministry's headquarters?

3. Name of the cabinet secretary?

4. Age of the chief officer in-charge?

- d) 25-30 years () b) 30-35 years () c) 35-40 years d) 40-45 years e) 45-50 years () f) 50-55years () g) 55-60 years () h) 60 years and above.

SECTION TWO. (Fill the spaces and tick on boxes provided.)

5. What is the responsibility of your ministry in tannery effluent management?

6. How effective are the policies and regulations law on tannery effluent management?

- a) Less effective () b) Effective () c) More effective () d) Not effective ().

7. What are the regulatory mechanisms formulated by your ministry in regulating tannery effluent discharge?

8. Is your ministry involved with County governments in deliberating issues pertaining to tannery effluent discharge management?

- a) Less involved () b) More involved () c) Not involved () d) Not sure ().

9. How has your ministry been able to deal with the issues of use and disposing of hazardous chemical effluents by industries?

- a) Less satisfied () b) Very satisfied () c) Not satisfied () d) Not sure ().

10. Are there any regulatory mechanisms that your ministry has developed or put in place in regards to the importation of hazardous chemicals for industrial use?

11. How has your ministry handled cases of environmental pollution of water resources in regards to industrial effluent discharge?

12. Are there any current legal framework that are in place that ensure effective enforcement on regulations on protection of water resources from tannery effluents?

13. What are some of the challenges you encounter in the implementation and enforcement of policy and regulations in industrial effluent management?

14. What is the responsibility of your ministry in industrial effluent management? Where does your ministry derive its powers from?

15. How can this issue of pollution of water resources by discharge of industrial effluents be eliminated and what do you recommend?

16. In your recommendation, what role and effort will your ministry put in place?

QUESTIONNAIRE FOR KEBS.

SECTION ONE. (Fill the spaces and tick on boxes provided).

1. Name of the Institution?

2. Location of the institution?

3. Name of the chief officer in-charge of the institution's operation?

4. Occupation of the chief officer in-charge in the institution?

5. Age of the chief officer in-charge?

e) 25-30 years () b) 30-35 years () c) 35-40 years d) 40-45 years e) 45-50 years () f) 50-55years () g) 55-60 years () h) 60 years and above.

SECTION TWO. (Fill the spaces and tick on boxes provided.)

6. For how long has your institution been in existence?

0-5 years () b) 5-10 years () c) 10-15 years () d) 15-20 years () e) 20-25 years f) 25-30 years g) 30 years and above.

7. What are some of the regulatory mechanisms employed by your institution in ensuring effective standard control in industrial effluent discharge?

8. What are the current legal framework in place that ensure effective enforcement on regulation on industrial effluent discharge?

9. How does your institution ensure quality standards and control in industry and commerce?

10. Does your institution carry out any testing of chemicals used in tanning and chemical waste discharged as effluent?

a) Weekly () b) Monthly () c) Quarterly () d) Annually ().

11. Does your institution hold enough power to formulate policies or regulations dealing with standards of quality in effluent discharge?

a) Less () b) Adequate () c) Absolute () d) None ().

12. Does your institution involve or cooperate with the government representatives of any industry in view of securing the adoption and practical application of standards?

a) Less involved () b) Much involved () c) Not involved ().

13. How does your institution ensure that industries comply with the regulations on imported industrial chemicals used in tanning process?

14. For industries that fail to comply with standards, quality and policies, how does the institution deal with such offenders?

15. Does your institution carry out inspection in tanneries to ensure that standards are adhered to?

a) Weekly () b) Monthly () c) Quarterly () d) Annually ().

16. What is the role of your institution in tannery effluent management?

17. What are the challenges that your institution faces in implementing and enforcing standards regulation in industrial activities?

QUESTIONNAIRE FOR KAM.

SECTION ONE. (Fill the spaces and tick on boxes provided).

1. Name of the organization?

2. Location of the organization's headquarters?

3. Name of the chief officer in-charge of the organization?

4. Occupation of the chief officer in-charge the organization?

5. Age of the chief officer in-charge?

- f) 25-30 years () b) 30-35 years () c) 35-40 years d) 40-45 years e) 45-50 years () f) 50-55years () g) 55-60 years () h) 60 years and above.

SECTION TWO. (Fill the spaces and tick on the boxes provided.)

6. For how long has your organization been in existence?

- 0-5 years () b) 5-10 years () c) 10-15 years () d) 15-20 years () e) 20-25 years f) 25-30 years g) 30 years and above.

7. What is the role of your organization in tannery effluent management?

8. Does your organization hold enough powers to formulate and enforce policies that ensure standard and quality control in tannery effluent management?

- a) Less () b) Adequate () c) Absolute () d) None ().

9. What are the regulatory mechanisms employed by your organization in regulating tannery effluent discharge?

10. What are some of the current legal frameworks that your organization has adopted in regulating and enforcing laws on tannery effluent activities?

11. Does your organization carry out inspections in tanneries so as to ensure adherence to standards?

a) Weekly () b) Monthly () c) Quarterly () d) Annually ().

12. Does your organization cooperate with the National and County government as well as other stakeholders in addressing tannery effluent management?

a) Less involved () b) Much involved () c) Not involved ().

13. Is your organization involved in licensing of industrial activities? If yes, after how long?

14. How does your organization deal with the issue of non-compliance by industries in standards and quality control?

15. What are some of the challenges in the enforcement of policies and regulations in tannery effluent management?

16. How can these problems be eliminated and what do you recommend as an organization?

QUESTIONNAIRE FOR KENYA WATER RESOURCES MANAGEMENT AUTHORITY.

SECTION ONE. (Fill the spaces and tick on boxes provided).

1. Name of the Institution?

2. Location of the institution's headquarters?

3. Name of the chief officer in-charge of the institution's operation?

4. Occupation of the chief officer in-charge in the institution?

5. Age of the chief officer in-charge?

- g) 25-30 years () b) 30-35 years () c) 35-40 years d) 40-45 years e) 45-50 years () f) 50-55years ()
g) 55-60 years () h) 60 years and above.

SECTION TWO. (Fill the spaces and tick on boxes provided.)

6. Does your Institution have authority to develop policies and guidelines in regards to the protection of water resources?

- a) Less () b) Adequate () c) Absolute () d) None ().

7. What are the regulatory mechanisms employed by your institution in regulating industrial effluent discharges into water resources?

8. What are the current legal frameworks that ensure effective enforcement of regulations on tannery effluent into water resources?

9. Does your institution carry out monitoring inspection in tannery industries so as to ensure control of pollution?

a) Weekly () b) Monthly () c) Quarterly () d) Annually ().

10. Does your institution determine applications for permits for effluent discharge into water bodies by industries? If yes, are there guidelines for renewal for licensing for effluent discharge?

11. Does your institution monitor and enforce condition attached to permits for water use by industries?

12. How does your institution regulate and protect water resources quality from adverse impacts of tannery effluent discharge?

13. Does your institution cooperate with government bodies both national and county for better regulation and management of tannery effluent into water resources?

a) Less involved () b) Much involved () c) Not involved ().

14. How does your institution deal with industries that don't comply with the guidelines and regulations in regards to effluent discharge into water bodies?

15. What is the role of your institution in tannery effluent management?

16. What are the major problems in the enforcement of tannery effluent management regulation in the country and who is responsible?

17. How can these problems be eliminated and what recommendations does your institution suggest to be put in place?

QUESTIONNAIRE FOR NATIONAL ENVIRONMENTAL MANAGEMENT AUTHORITY.

SECTION ONE. (Fill the spaces and tick on boxes provided).

1. Name of the Institution?

2. Location of the institution's headquarters?

3. Name of the chief officer in-charge of the institution's operation?

4. Occupation of the chief officer in-charge in the institution?

5. Age of the chief officer in-charge?

h) 25-30 years () b) 30-35 years () c) 35-40 years d) 40-45 years e) 45-50 years () f) 50-55years ()
g) 55-60 years () h) 60 years and above.

SECTION TWO. (Fill the spaces and tick on the boxes provided.)

6. How long has your institution been in existence?

0-5 years () b) 5-10 years () c) 10-15 years () d) 15-20 years () e) 20-25 years f) 25-30 years g) 30 years and above.

7. Does your Institution have authority to develop policies and guidelines in regards to tannery effluent discharge?

a) Less () b) Adequate () c) Absolute () d) None ().

8. What are the regulatory mechanisms employed by your institution in regulating tannery effluent discharge?

9. What are the current legal framework in place that ensure effective enforcement of regulation in tannery effluent discharge?

10. Does your institution carry out monitoring inspection in tannery industries so as to ensure control of pollution?

a) Weekly () b) Monthly () c) Quarterly () d) Annually ().

11. Does your institution determine applications for permits for effluent discharge into water bodies by industries? If yes, are there guidelines for renewal for licensing for effluent discharge?

12. Does your institution monitor and enforce condition attached to permits for effluent discharged into water bodies by industries?

13. How does your institution regulate and protect water resources quality from adverse impacts of tannery effluent discharge?

14. -Does your institution cooperate with government bodies both national and county for better regulation and management of tannery effluent into water resources?

a) Less involved () b) Much involved () c) Not involved ().

15. How does your institution deal with industries that don't comply with the guidelines and regulations in regards to effluent discharge into water bodies?

16. What is the role of your institution in tannery effluent management?

17. What are the major problems in the enforcement of tannery effluent management regulation in the country and who is responsible?

18. How can these problems be eliminated and what recommendations does your institution suggest to be put in place?

QUESTIONNAIRE FOR THIWASO

SECTION ONE. (Fill the spaces and tick on boxes provided).

1. Name of the Institution?

2. Location of the institution's headquarters?

3. Name of the chief officer in-charge of the institution's operation?

4. Occupation of the chief officer in-charge in the institution?

5. Age of the chief officer in-charge?

- i) 25-30 years () b) 30-35 years () c) 35-40 years d) 40-45 years e) 45-50 years () f) 50-55years () g) 55-60 years () h) 60 years and above.

SECTION TWO. (Fill the spaces and tick on boxes provided.)

1. For how long has your institution been in existence?

- 0-5 years () b) 5-10 years () c) 10-15 years () d) 15-20 years () e) 20-25 years f) 25-30 years g) 30 years and above.

2. Does your Institution have authority to develop policies and guidelines in regards to the protection of water resources?

- a) Less () b) Adequate () c) Absolute () d) None ().

3. What are the regulatory mechanisms employed by your institution in regulating tannery effluent discharge into water resources?

4. What are the current legal frameworks that are in place that ensure effective enforcement of tannery effluent discharge into water resources?

5. Does your institution carry out monitoring inspection in tannery industries so as to ensure control of pollution?

a) Weekly () b) Monthly () c) Quarterly () d) Annually ().

6. Does your institution determine applications for permits for effluent discharge into water bodies by industries? If yes, are there guidelines for renewal for licensing for effluent discharge?

7. Does your institution monitor and enforce condition attached to permits for water use by industries?

8. How does your institution regulate and protect water resources quality from adverse impacts of tannery effluent discharge?

9. Does your institution cooperate with government bodies both national and county for better regulation and management of tannery effluent into water resources?

a) Less involved () b) Much involved () c) Not involved ().

10. How does your institution deal with industries that don't comply with the guidelines and regulations in regards to effluent discharge into water bodies?

11. What is the role of your institution in tannery effluent management?

12. What are the major problems in the enforcement of tannery effluent management regulation in the country and who is responsible?

13. How can these problems be eliminated and what recommendations does your institution suggest to be put in place?
