

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES



**LEATHER INDUSTRY AND ENVIRONMENTAL
CHALLENGES:**

The Case of Haffede Tannery



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February, 2015

Addis Ababa, Ethiopia

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DECLARATION

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LIST OF ABBREVIATIONS AND ACRYNOMS

BOD	Biological Oxygen Demand
BAT	Best Available Technologies.
CETP	Common Effluent Treatment Plant
COD	Chemical Oxygen Demand
CREGS	Climate- Resilient Green Economy Strategy
CSA	Central Statistics Agency
ECPC	Environmental Cleaner Production Center
EIA	Environmental Impact Assessment
EIP	Eco-Industrial Park
ELIA	Ethiopian Leather Industry Association
EMS	Environment Management System
EPA	Environmental Protection Agency
ETP	Effluent Treatment Plant
FDRE	Federal Democratic Republic of Ethiopia
FEPA	Federal Environmental protection Authority
FGD	Focus Group Discussion
GTP	Growth and Transformation Plan
HAFPLC	Haffed Tannery Privately Limited Company
LIDI	Leather Industry Development Institute.
MoEF	Ministry of Environment and Forest
MoFED	Ministry of Finance and Economic Development
MoFEI	Ministry of Forest and Environment of the Government of India
MoI	Ministry of Industry
MoLSA	Ministry of Labor and Social Affairs
ORLEMB	Oromia Regional state Land and Environment Management Bureau
STEO	Sebeta Town Environment Office
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization

ABSTRACT

The leather Industry is one of the industries which have effect on the Environment especially if it is not managed properly. In Ethiopia the leather industry is one of the main exports earning and job creation. On the other hand, it has side effects to the environment, as tanneries do not want to include cost for environmental protection, because it increases their cost of production. This research paper assessed the leather Industry and Environmental challenges, the case of HAFPLC which is located in Sebeta municipality administration.

The study uses primary and secondary data sources. Survey questionnaires, Interview with key respondents were used while field visit also done to “Roge” villagers and FDG was made with community leaders to have deep understanding of the situation.

This research paper reveals that HAFPLC is not complying adequately with the environmental standards set by MoEF, though there is some improvement now. There is an environmental policy, standards and regulation gap according to the findings of this case study. The tannery chemical usage and safety monetary handling system is not found to be reliable. The tannery has primary treatment plant but it had not been operated based on the standards of MoEF.

The main challenges for implementation of environmental standards and regulations are , HAFPLC is not in a position to run the ETP cost financially , knowledge limitation on ETP operation and maintenance capacity, weak inspection capacity by environmental authorities, weak coordination between stakeholders, absence of CETP which minimizes the overall treatment cost are the main binding challenges.

This research recommends the Establishment of Industrial Parks with CETP for Ethiopian tanneries including HAFPLC which helps in protecting the “Roge” village environment with minimizing ETP cost. More ever; ORLEMB, MoI, LIDI should work in coordinated mechanism, more resource should be allocated to environmental institutions established at federal, regional, and “woreda” level and capacity building should be done.

Key words: Environmental policy, Environmental regulation and standards, Environmental sustainability.

CHAPTER ONE

I. INTRODUCTION

1.1. Back ground

The tanning industry is means of job creation an export earnings for developing countries. However, Leather industry is one of the pollutant industries and if there is no proper way of treating the waste from the industry it has harmful effect on the environment (Favazzi, 2003).

Ethiopia has great potential of livestock with cattle population of 53 million, with sheep and goat populations of 25 and 24 million, respectively, makes the country first in Africa; with an annual off-take rate of nearly 10% for cattle, 33% for sheep and 38% for goats, (CSA, 2013). Cognizant of this comparative Advantage the Ethiopian government makes the leather industry as one of the priority areas in the manufacturing industry. The Ethiopian government wants to bring accelerated economic growth which needs vibrant growth of different sectors including the manufacturing sector. Leather and leather products are among the main manufacturing export products. Within the manufacturing sectors, the leather industry comes as the leading exporter the country was able to generate above 123.4 million USD in the year 2014 (MOI, 2014).

However, Leather industry is one of the pollutant industries and if there is no proper way of treating the waste from the industry it has harmful effect on the environment. In Ethiopia also there is a concern on the waste of the tanneries. The industrial establishments huge potential of for sustained economic development of the country has been constrained for they were not designed and operated in sustainable manner ,most of tanneries do not have treatment facilities and environmental management systems, as a result they simply discharge their wastes into the environment; etc. Thus, are causing serious environmental and public health problems in particular in urban centers. It is obvious that the effect will further extend to rural areas as well (EPA, 2005)

It is in the interest of tanneries to produce as much tanned leather as possible, to the lowest possible cost, avoiding paying added costs for the reduction of the effects of pollution, which will increase proportionally to the commercial success of the tannery, while it is unacceptable for the surrounding communities. Postponing the solution of this problem will bring serious problems to the management of the environment, up to the extreme consequence of the impossibility to live in the area (Favazzi, 2003).

The environment protection, about which so much it is talked about, it is actually the protection of quality of life and welfare. The same welfare resulting from the work of tanneries, among the other industries, in the sense that any inhabited place where there are industries and that shall last in the time, shall find some sort of dynamic equilibrium with the environment. This means that a society shall reorganize its economy in order not to waste and not to pollute the environment. State regulations aimed to the control of polluting production in the tanning industry is therefore based on the principle of “who is receiving water has the duty to give it back as it has receive it or must pay for the cost of the recourse”(Favazzi,2003).

The push for development shall be moved from the field of quantity to the field of quality and variety: first of all to produce with less water, to produce with environment friendly technologies, in the end to use efficient wastewater treatment systems. Coming to this point, normally, we have to face the indifference of the tannery industry entrepreneurs, who put on the table their contribution to society into creating jobs, as an important achievement recognized useful to society. However, this contribution does not change the physical law under which the industrial evolution has to be considered: environment must be protected for the welfare and well-being of women and men living in the surrounding communities. It is clear that environment protection might create in the immediate future a reduction of production and even a reduction in the potential investment in the near future, related to the production of tanned leather, but the complexity of the social system and the push towards a

better quality also is a potential for the creation of a number of “important and socially useful” jobs: a clean production is usually repaid by a widely better quality (Favazzi, 2003).

In order to achieve this aim, some mechanisms shall be considered, mechanism different from those of the automatic mechanism of the market, which usually reward only the minor cost or the no cost. The subjects able to put these mechanisms into action are public agencies, the role of which is to understand and serve to common interest in the short and long period: we shall consider the government as the main actor for the implementation of fare policies of incentives. (Favazzi, 2003)

This research paper will assess current situation of Ethiopian leather industry development and challenges on the Environment specific to HAFPLC.

1.2. Statement of the problem

Tanning industry involves chemical reactions and mechanical changes which use a lot of water. It generates waste most of the time in developing countries which are discharged to rivers or other water areas or to open field land areas. It could have adverse effect on the environment and human if it is not properly managed due to the presence of dangerous chemical and elements such as chromium, sulfur, etc. (Favazzi, 2003).

This industry is one of the major exports earning in the manufacturing industry in Ethiopia. However, there is challenge in tapping its economic benefit with minimizing its pollution effect to the environment. It becomes a delicate balance to maintain practically both keeping the environment sustainable and the growth of the industry.

Implementing environmental policy of the country in harmony with the required growth of leather industry becomes a difficult task for the government .It is planned to reach the annual export target of 500 million USD export by the end of 2015 from the leather industry (GTP, 2010). However, there is conflict between this economic interest and environmental

sustainability because of the fact that most of the tanneries discharge their waste from the tanning process without proper treatment.

A good number of tanneries in Ethiopia have primary and secondary treatment to manage their wastes, but they don't follow the right procedure to treat the waste by applying proper dosages of chemical, good maintenance, and continuous monitoring and evaluation. There are about 12,500 m³ waste water and 150 tones solid wastes generated per day from all tanneries (LIDI, 2013).

Tanners do not want to incur the cost of treatment of their waste from the tanning process which will be included in the production cost and affects their competitiveness in price; it is a challenge how to incentivize tanneries to use effluent treatment plants i.e. primary, secondary and tertiary effluent treatment plants with minimum cost. The societies around tanneries complains about smell, health problem which violets their right to leave in clear environment. Untreated wastes also damages animal health and generally affects the living and non-living things in the environment.

One of the most damaging ways in which tanning industries affect the internal individual process integrated aspects and the external ecological system involves the different waste water disposal and treatment schemes. Preference of inadequate and costly end-pipe waste treatment technique to the technology aided preventive approach at the source in each process step is a puzzling issue of most Ethiopia tanneries (Zelege, 2011).

The government of Ethiopia formulated different proclamations, regulations and guide lines for implementation of its environmental policy .However, there are concerns and complaints on their implementations, i.e. establishing policy frame work alone does not bring result unless otherwise different stakeholders work in coordination for its implementation.

It is right time that the country needs more research, innovative and practical solutions to manage its industrial development including the tanning industry in sustainable manner. The challenge will become more evident in future when the economy is transformed to

industrialization; unless the task of environment protection is started at the early step of the industrialization phases.

Hence, this research will contribute for the literature and make possible recommendations by assessing the environmental policy implementation specific to the leather industry taking HFAPLC as a case study.

1.3. Objectives of the Study

1.3.1. General Objective

The main objective of the research is assessing environmental challenges of the leather industry in the case of the HFAPLC with waste management problems of the tannery targeted to downstream community wellbeing.

1.3.2. Specific objectives

In view of the above fact, this research paper aims at the following specific objectives.

- ❖ To find out the conception of environmental protection held by HFAPLC and government stakeholders.
- ❖ Assess how leather industry environmental guidelines are implemented by HFAPLC
- ❖ Assess the major impacts resulted in the downstream villages lively hood by HFAPLC.
- ❖ To propose possible recommendation of minimizing environmental pollution of the leather industry without affecting the industry growth.

To meet the above objectives the following research questions were used in this research:-

1.4. Research Questions

- What are the general conceptions of HFAPLC and other stake holders towards environmental sustainability?
- What is the current status of HFAPLC in implementing environmental guide lines to the leather industry?

- What are major challenges in the implementation of environmental policy and regulation to HFAPLC?
- What are the impacts to downstream villagers and the environment in general?

1.5. Significance of the Study

This study will contribute to the Academic community and policy makers specifically.

- It will add value to the exiting literature of leather Industry development and Environmental challenges in Ethiopia.
- To serve as a stepping stone for other researchers who would like study in this area in a wider scale.
- To Make possible recommendation for HAFPLC and other stake holders to use efficient system effluent treatment of the waste released of the tanning process.

1.6. Scope and limitation of the study

It would have been better to assess the case of more tanneries. However, due to resource and time constraints, only HAFPLC is taken as case study. This tannery is selected because it is one of the tanneries which have big production capacity in Ethiopia and there are complaints from “Roge” villagers from its waste treatment. Hence it would be a good case study for the problem raised in this research paper, i.e. `` leather industry and environmental challenges``.

1.7. Research Methodology

1.7.1. Research Design

Primarily, Qualitative research approach was used for this Study. It was helpful for critically analyzing and describing the phenomenon of the research topic. Schwandt(2007) believes that understanding is itself a phenomenon which lies at the core of the qualitative research because “qualitative methodology and underlying philosophy are highly appropriate for understanding complex issues”. This is mainly to create a picture which covers the whole image in it by collecting data for further examination through a variety of angles or different peoples. It is

also supported by a Quantitative approach for finding empirical evidences related to the subject matter under discussion.

The survey study here consists of both quantitative and qualitative mixed approaches. In order to gather quantitative information at the factory level, questionnaires with a mixture of closed and open-ended questions were used. These quantitative responses were used to answer questions that are mainly descriptive in nature that would enable generalization. Qualitative research approach on the other hand, was used to identify the appropriate dimensions of various concepts. In-depth interviews and group discussions were administered based on the survey to contextualize, interpret and help understand the participants' perspectives in more detail. Besides, observation and document analysis methods were used as alternative techniques of obtaining information on the subject matter.

Both Quantitative and Qualitative approaches were used mainly due to nature of some data that are difficult to use one research method. Triangulation which this study applied most is defined as the use of different methods of collecting data with the aim of comparing different aspects of the same phenomenon. It is often believed to help in validating or verifying the accuracy of information.

1.7.2. Type of research.

Descriptive research was used to systematically explore Leather Industry and Environmental challenges, the case of HAFPLC. It helps to study and characterize a complex functioning unit, investigated in its natural setting and it is contemporary (Johansson, 2003). This design helps the researcher to use multiple data sources and cross validate the result through triangulation (Yin, 1994; Johansson, 2003). Thus, Descriptive design enables using flexible research approach by using multiple sources of data involving document review, interview, and questionnaires and to use both qualitative and quantitative analysis techniques.

1.7.3. Data Collection Instruments and Sources of Data

The instruments used to collect the necessary information regarding assessment of environment policy guide lines to leather industry related to HAFPLC were secondary data

analysis, focus group discussion, interviews and questionnaires. Documents analysis and observation instruments were also used to assess the wastewater management efficiency and evaluate its current status of the tannery.

In this study both primary and secondary data sources were used. With regard to secondary data source, relevant information were collected by consulting different pertinent documents such as, the Ethiopian leather industry and Environmental policy, countries experience and other related literatures were thoroughly reviewed. These include reports, journals, books; websites etc. Primary Data were collected after developing questionnaire and interview questions. The researcher well informed the factory workers about the purpose of the questionnaire and procedure to be followed to fill it. In addition, to have clear idea about the subject matter under this research, in depth interviews were made with officials and experts of relevant government institutions including LIDI, MoI, ORLEMB , STEO and MoEF. Key respondent from ELIA was also interviewed to know the position of the association regarding the subject matter under study.

1.7.4. Data Collection

Prior to conducting the actual data collection, a visit to the study site, HAFPLC and the downstream villages along sebeta river was made to establish some contacts with key informants and influential leaders on the ground to explore the study area and get some general insights into the nature of the problem. Secondary data were reviewed from available information. The information that were collected through the questionnaire also posed the issues which should be addressed in greater depth and follow-up, and provides a basis for selecting individuals whose further participation was important. The FGD was conducted soon after the factory workers' questionnaire administration was completed. The size of key informants and group discussion were determined depending on the detail of information needed and type of issues arising during the survey. In-depth interview and focus group discussions were recorded to capture important points.

1.7.5. Sampling Procedure and techniques

In order to determine the sample size for the questionnaire survey, factory workers at different levels were stratified based on the problem content knowledge and occupation. To do this, lists of the entire factory workers were primarily obtained from the factory administration then stratified in to three groups. The first group consisted production and quality heads shift leaders and supervisors, while Machine operators constituted the second group. The last group included casual workers. The sample size for the survey was 74, which is believed to be representative of the total population of 250 workers during the field survey, i.e. it is 30% of the total population of the survey.

The FGD was made with “Roge” village farmers community leaders. Purposive sampling determined number of respondents from stakeholder institutions. With pre arranged time schedule that was made with the respondents and key informants, the interviews were conducted by the researcher with each of these informants in their office.

1.7.6. Data analysis

After relevant information was collected, data presentation and analysis were the necessary step. The information collected from both primary and secondary data sources through review of different documents and in depth interviews with key informants, personal observations as well as questionnaire survey were organized and narrated. To be specific, opinion of respondents” on the questionnaire survey were summed up by frequency counts and then converted into percentages to provide the understandings of issue under discussion numerically. The descriptive data obtained from the structured interviews and open ended questions were analyzed by identifying the themes which informed the categories as they emerge from the data. Facts that were extracted from different documents were analyzed thematically and served to confirm study outcomes accordingly. Indeed, data analysis was presented using tables and figures where necessary. Ultimately, generalizations were made and presented accordingly for the data by way of narrating and interpreting the situations.

1.8. Organization of the study

This study consists of five chapters. The first chapter provides brief introduction of the study which includes, background, statement of the problem, objectives and significance of the study, research questions, scope and limitations of the study, and research design.

In the second chapter, conceptual frame work of the study, policy and legal frame work for the environment management and empirical literature review were included. The third chapter contains data description and chapter four has data interpretation and analysis. Finally chapter five presents summary of findings, conclusions and recommendations.

CHAPTER TWO

2. LITERATURE REVIEW

The literature review part contains conceptual frame of the study concerning the theoretical frameworks by which the overall research tasks guided. It also covers some empirical literature review which helps in getting practical experience that could be taken as lesson and use full in making future recommendations.

2.1. Conceptual framework of the study

This section covers important theoretical literature reviews related to the tanning industry which includes, leather manufacturing process flow, sustainability and the tanning industry, pollution and human health, tannery wastewater characteristics and management schemes, cleaner technologies, industrial ecology and EIPs.

2.1.1. Leather manufacturing process flow

In primitive times man used animal skins to cover himself in order to protect him from the environment. Although skins were resistant and available they had some weaknesses: they were damp, they would decompose and when trying to avoid purification by drying they lost their mechanical properties such as flexibility and softness due to drying. Because of this, leather production became an important craft dated more than 3000 years old. This process of turning skin into leather product is called tanning (Favazzi.A, 2003).

Tanning is a process where putrefaction is avoided while maintaining or enhancing the mechanical properties of being flexible and soft even when dry. Hides and skins gain durability and can be used in a wider range of products because of this process. These skins usually come from large and medium size mammals such as the ox, cow, calf, buffalo, sheep, goat, pig and horses; although marine animals and some reptiles are also processed.

Generally speaking leather processing is a technology that is composed of a series of step Operations that aim at isolating collagen by removing non-collage nous components of skin

and then improving the material by making it more resistant to environmental and use factors Favazzi.A, 2003).

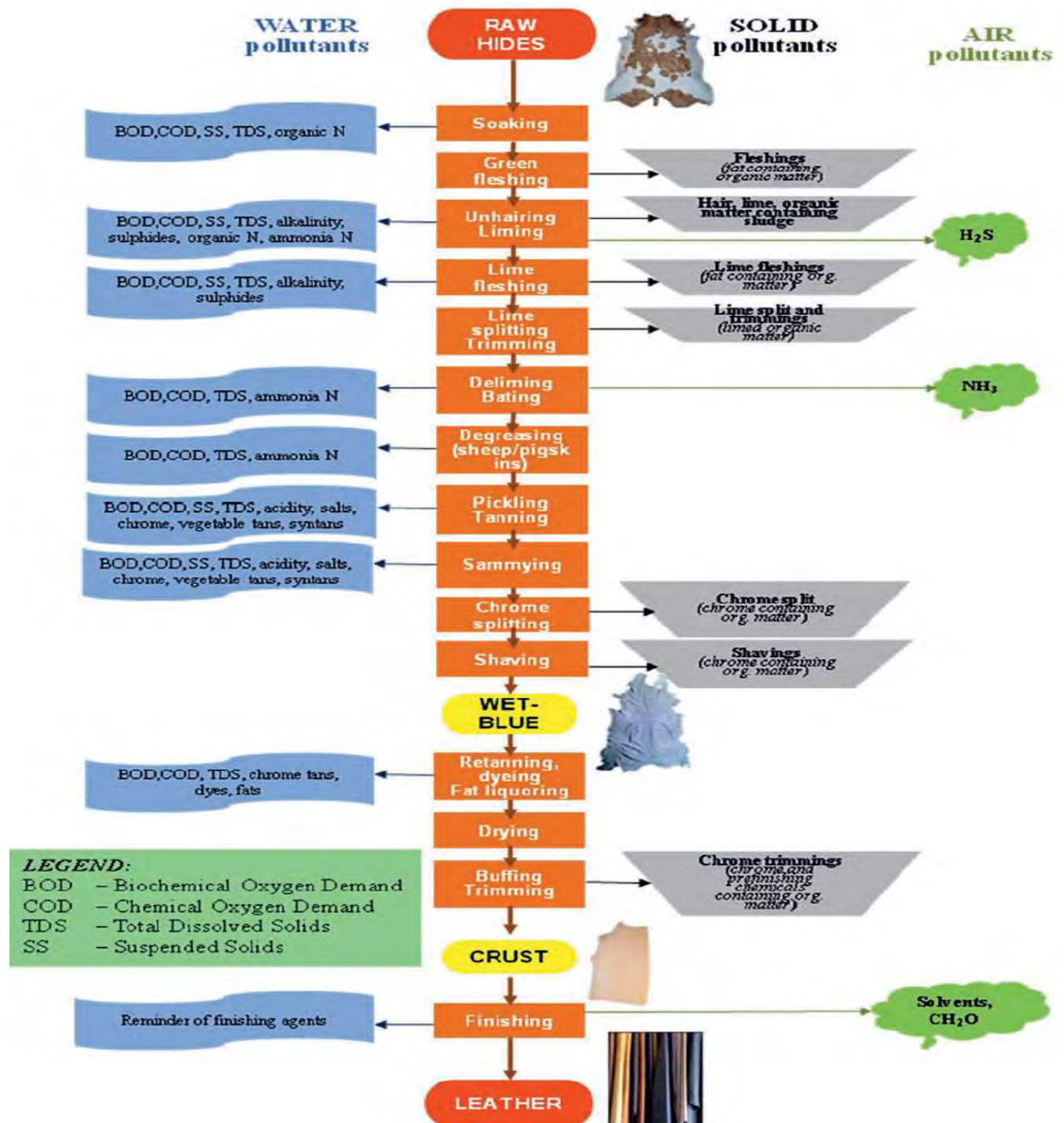
Processing hides and skins to convert them into leather has evolved through the years from a manual craft process into chemical intensive industrial process. According to Sharp (1983), it is composed of the following three main stages:-

1. Pre-tanning (also known as beam house operations): this consists of unit operations from skinning the animal and preparing the skin for transport by curing, to treating the skin prior to tanning (washing, liming treatment, unhairing, fleshing, de liming, bating and pickling).
2. Tanning (also known as tannery operations): Tanning through chemical or vegetable treatment of the skin.
3. Post-tanning (finishing operations): That consists of operations to obtain the finishing mechanical and esthetic characteristics usually containing steps such as splitting to gain uniformed thickness, washing residue from tanning process, pH neutralizing, dyeing, flattening, oiling, drying and rolling.

These steps require many natural resources such as water, metals, and derived chemicals in order to achieve the desired quality. If better manufacturing practices and control systems are not in place the tanning process can become an important environmental issue. Because of its potential and the many companies that have poor manufacturing practices, the tanning industry has generally been identified as a source of pollution and described as a problematic industrial sector in terms of environmental performance. Western countries this has been met by legislation that outline and delimit industrial environmental performance. According to the European Commission in order to remain competitive in the global market place, European leather producers must exploit more efficiently their raw materials and avoid wasting collagenous material (hides and skins) that constitutes valuable raw material for other industries and agriculture, as well as, have high adverse environmental and cost implications.

By-products should be either reused/recycled or converted into new, higher value Products (DG Enterprise and Industry, 2012).

Figure 1:-schematic of tanning process starting from raw hides and skins to finished leather



Source: UNIDO(2011:p.8)

2.1.2. Sustainability and the tanning Industry

According to Favazzi(2003), Contemporary societies are called to respond to two orders of problems: the MATERIAL, represented by the technology and by the production and the SOCIAL, involving the quality of life and the human relationship. Both orders evolve in conformity with the internal laws regulating the relation between industry and society.

However, there is a fundamental difference. While the laws of the material order are the economical laws built on well known principles, to which the subjects shall adapt regard to the competition and the development, those of the social order show a variety of facets, that in some cases might result incompatible and in conflict with the economy. The economy of the environment is now placed side by side to the economy of recourses; together with the traditional inputs and outputs represented by labor and consumption, we have started to talk of natural recourses and waste.

Therefore, the laws of the market have resulted uncompleted. First of all because these laws take into consideration only the monetary aspects, but neglect the not-monetary aspects so important for the quality of life. The recourses to which we are not able to give a monetary value are the purity of the air, of the water and of the soil around us. How much is the price for a cubic meter of pure air we breathe? In order to solve these kinds of problems, there are some economical approaches to the sustainable development. The following approaches are suggested by Favazzi(2003).

- A) The functionalist approach, here the laws of environment are treated as an aspect of development and are managed by the traditional laws of economy, production and consumption;
- B) The economy of environment, dedicating great attention to the environment pollution and to the management of natural recourses;
- C) The economy of ecology, completely moving the prospective and saying that the salvation of humankind's economy is subordinated to the reconstruction of the economy of nature.

In reality, it will not be practical to side to only to one of the above approaches, rather it is required to balance between economic growth and environmental issues, if the economy is not allowed to grow it would be difficult to protect and sustain the environment, vice versa,

looking only fast growth would be disastrous to the well being of the society and increases the cost of future generation.

2.1.3. Pollution and human health

According to Kanagaraj et al. (2006), the leather industry throughout the world has been identified closely with the generation of air, liquid and solid waste pollution. The tanneries generate huge amounts of liquid and solid wastes and emit obnoxious smell caused by the degradation of protein material of skin and generation of gases such as NH_3 and H_2S and CO_2 . Chrome tanning is the most common type of tanning in the world and in Ethiopia. Chrome tanned leathers are considered of top handling quality, high hydro-thermal stability and excellent user properties. However, chrome waste from leather processing poses a significant disposal problem. It occurs in three forms: liquid waste, solid tanned waste and sludge. In most countries, regulations governing chrome discharge from tanneries are stringent. Today, all tanneries in developed countries must thoroughly check their waste streams (UNIDO, 2000). Chrome discharge into those streams is one of the components that have to be strictly controlled.

Inappropriate management of the tanning industry has detrimental effect on health and environment, i.e. untreated effluents can negatively influence water supply, found to be severely under stress by the effects of climate change. Excessive Chromium III uptake can cause health issues and skin rashes; exposure to Chromium VI can cause: skin rashes, upset stomachs and ulcers, respiratory problems, weakened immune systems, kidney and liver damage, Alteration of genetic material, lung cancer and death (UNIDO, 2000).

Access to clean and sustainable food resources are essential for the preservation of one of the largest livestock populations in the world. Untreated waste generated from the tanning process can negatively influence the animal food supply; for example, anomalous chromium can cause respiratory problems, a lower ability to fight disease, birth defects, infertility and tumor formation. It can damage the gills of fish; it can alter genetic materials and cause cancer (UNIDO, 2000).

2.1.4. Tannery wastewater characteristics and management schemes

Mactacalf and Edydy (2003) characterize waste water in terms of its physical, chemical and biological composition with the parameters all interrelated. Characteristics of wastewater generated from the tanning process in each production stage can respectively be seen for beam house process as, BOD, COD, salt, pesticides, flesh, hair, suspended solids, sulfate, ammonia, base, chloride for tanning process (chrome tanning) as, BOD, COD, salt, acid, chromium, suspended solids and for finishing process as BOD, COD, salt, chromium, oils (Metacalf and Eddy, 2003).

A significant number of operations within a tannery are wet operations consuming large amounts of water, chemicals and energy and leading to large amounts of polluted water. Through “process integrated” measures a significant reduction of water consumption and pollution load can be achieved, however tanneries keep producing waste water requiring special treatment. In cases where the potential for “process integrated” measures has worn out, further pollution reduction has to be found in the improvement of end-of-pipe measures (Layman, 2002)

2.1.5 .Cleaner technologies

Confronted with increasing legal and social pressures, no tanner can afford the luxury of not being familiar with the main issues and principles of environmental protection pertaining to tannery operations. Obviously, pollution prevention, the persistent promotion of cleaner leather processing, which ultimately leads to lower treatment costs, remains the supreme priority (UNIDO, 2011).

By applying industrially proven low-waste advanced methods such as the use of salt-free preserved raw hides and skins, hair-save liming, low-ammonia or ammonia-free deliming and bating, advanced chrome management systems, etc., it is possible to decrease significantly the pollution load, namely: COD and BOD₅ by more than 30%, sulphides by 80-90%, ammonia nitrogen by 80%, total (Kjeldahl) nitrogen by 50%, chlorides by 70%, sulphates by 65%, and chromium by up to 90%. Yet, despite all preventive measures, there is still a considerable amount of pollution load to be dealt with by end-of-pipe methods (UNIDO,2011).

The pressure to adopt cleaner technologies normally emanates from environmental imperatives such as the need to meet specific discharge norms, reduce treatment costs or comply with occupational safety and health standards. The typical primary targets are: lower water consumption, improved uptake of chemicals, better quality/re-usability of solid waste, and reduced content of specific pollutants such as heavy metals and electrolytes.

The spread of cleaner technologies and processes has been neither spontaneous nor extensive. For all the claims about favorable cost-benefit ratios and/or environmental benefits to be derived from many of these technologies, tanners are not quick in adopting them, be it due to inertia, higher costs or the limitations mentioned earlier (UNIDO, 2000).

Due to variations in raw material, process, chemicals, water consumption, etc., it is small wonder that figures about pollution load in the literature vary a lot and should be interpreted very cautiously. Wastewater treatment is a multi-stage process to purify wastewater before it enters a body of natural water, or it is applied to the land, or it is reused. The goal is to reduce or remove organic matter, solids, nutrients, Cr and other pollutants since each receiving body of water can only receive certain amounts of pollutants without suffering degradation. Therefore, ETP must adhere to discharge standards limits usually promulgated by the relevant environmental authority as allowable levels of pollutants, for practical reasons expressed as BOD₅, COD, suspended solids (SS), Cr, total dissolved solids (TDS) and others. The three main categories of tannery wastewater, each one having very distinctive characteristics according to (UNIDO, 2011) are:

- a) **Effluents emanating from the beam-house** – liming, deliming/bating, water from fleshing and splitting machines; they contain sulphides, their pH is high, but they are chrome-free.
- b) **Effluents emanating from the tan yard (tanning and re-tanning, sammying)** – high Cr content, acidic.
- c) **Soaking and other general effluents, mainly from post-tanning operations (fat-liquoring, dyeing)** – low Cr content.

It is very important to segregate these streams and to pre-treat them separately according to their characteristics to avoid possible safety risks (formation of deadly hydrogen sulphide) and to reduce the cost of treatment and sludge disposal (to avoid contamination of sludge with Cr). The mixing of liming and tanning streams gives rise not only to the obnoxious smell typical of poorly managed tanneries; the resulting lethally poisonous gas, hydrogen sulphide (H₂S), is still by far the most frequent killer in tannery accidents, which occur mainly in inadequately ventilated spaces, especially in pits and channels. The volume and pollution load of sanitary wastewater in comparison with industrial wastewater is insignificant. Very arbitrarily and not quite consistently we speak of the following main phases of treatment (UNIDO, 2011):-

A. Physical-chemical treatment (primary)

The objective here is the removal of settle able organic and inorganic solids by sedimentation, and the removal of materials that will float (scum) by skimming. Approximately 25-50% of the incoming biochemical oxygen demand (BOD₅), 50-70% of total suspended solids (SS), and 65% of the oil and grease are removed during primary treatment. The effluent and sludge from primary sedimentation are referred to as primary effluent and sludge. The wastewater is received in wastewater collection sump having arrangement of screen chamber and grit removal chamber. Screen chamber and grit chamber is provided for the removal of coarse grit, floating matter and any suspended large particles which can damage internal part of pumps and other rotating equipment (Metcalf and Eddy,2003).

From wastewater collection sump, wastewater is pumped using effluent feed pump to equalization tank. Before equalization tank, effluent is passed through oil and grease trap for the removal of floating and insoluble oil and grease particles. Oil and grease trap is a baffled wall channel where wastewater is subjected to up and down flow for the removal of floating particles at the top surface. Separated oil and grease layer is collected from the top layer by manual skimming operation through collecting troughs and drain pipe. From oil and grease trap effluent is collected in equalization tank. Equalization tank is provided to ensure the complete mixing of varying quality and quantity. Complete mixing is achieved by floating type submerged mixers.

B. Biological treatment (secondary)

In most cases, secondary treatment follows primary treatment, its goal being the removal of biodegradable dissolved and colloidal organic matter using aerobic biological treatment processes. Aerobic biological treatment is carried out in the presence of oxygen by aerobic micro-organisms (principally bacteria) that metabolize the organic matter in the wastewater, thereby producing more micro-organisms and inorganic end products (principally CO₂, NH₃, and H₂O). Several aerobic biological processes are used for secondary treatment and the differences among them have to do primarily with the manner in which oxygen is supplied to the micro-organisms and with the rate at which organisms metabolize the organic matter (Metcalf and Eddy, 2003).

Biological treatment is achieved by providing activated sludge process. In this treatment soluble BOD is stabilized by oxidation of organic matter by microorganisms. Nutrient and food is supplied to microorganisms for enhancing their growth. Oxygen required is provided by air blower through non-clog type membrane diffusers to achieve higher rate of oxygen transfer efficiency. Mixed liquor overflow from aeration tank is taken into secondary clarification process, for the separation of microorganisms under gravity. Bottom sludge from secondary clarifier is re circulated back in the aeration tank. Excess biomass is transferred into bio sludge tank. Clear overflow from secondary clarifier is transferred to the tertiary treatment (Metcalf and Eddy, 2003).

C. Advanced (tertiary) treatment

Tertiary or advanced wastewater treatment is employed to reduce residual COD load and/or when specific wastewater constituents are not removed by previous treatment stages.

Tertiary treatment consists of chemical oxidation, pressure sand filter and activated carbon filter. Effluent from biological treatment is passed through chemical oxidation tanks, where Hydrogen Peroxide dosing is done. Mixing in chemical oxidation tank is provided with air agitation using separate air blowers. Effluent from chemical oxidation tank is collected in intermittent storage tank. From where effluent is further subjected to pressure sand filter and

activated carbon filter. Suspended solids get removed in pressure sand filter and activated carbon filter provides treatment for removal of color and COD so that final treated wastewater meets the discharge norms. Backwashing of both the filters is done daily for cleaning of filter beds. The backwashed water is diverted back into wastewater collection sump for further treatment (Metcalf and Eddy, 2003).

2.1.6. Industrial ecology

Industrial ecology introduces the possibility to learn from natural ecosystems to design and engineer industrial systems to reduce the ecological impact of human activity to levels natural systems can sustain. In ecological systems the flow of materials is cyclic, the wastes are recycled and energy is cascading. On the contrary, industrial ecosystems often emphasize the throughput of materials. Ecological systems put emphasis on interaction and interdependence related to the stability of the systems. Industrial systems emphasize independence and competition. Biological analogy is useful in framing industrial ecology. However, the ultimate differences between ecological systems and human systems should be considered; e.g. biological systems evolve through biology and culture, human systems also through technology. Moreover, industrial systems are dependent on the resources and services provided by the biosphere (Jelinski et al., 1992:pp.793-797).

Industrial ecology takes a material and energy flow approach to human society; it does not regard society merely from the point of view of organizational and social monetary and production processes. Subsequently, materials, energy and information are flowing in ideal industrial systems the way they do in ecosystems. The use of energy and material is optimized and the generation of waste minimized. Wastes from one process can be used as raw materials in another (Frosch & Gallopoulos, 1989:PP.144-152). Industrial ecology seeks strategies to increase efficiency and reduce the impact of these flows.

Industrial ecology takes a systems approach to flows. This is convenient as material and energy flows do not respect the general boundaries of regions, countries etc; the flows can even be global. The contribution of industrial ecology to regular environmental management is that the analysis crosses borders of countries and goes beyond individual products. Industrial ecology

can have a few approaches: it can concentrate on products and materials or it can have a regional industrial ecosystem approach (Korhonen, 2002:pp.170-185). The first approach uses tools like material flow analysis including substance flow analysis, life cycle analysis and design for environment.

2.1.7. Eco-Industrial Parks

Eco-industrial parks pay attention to material and energy exchanges between companies in local and regional economies. It concentrates on closing the loop of materials and enhancing energy cascading in industrial areas. Close synonyms for eco-industrial Park are e.g. industrial ecosystem, industrial symbiosis, eco-industrial estate, eco industrial network, eco-industrial development, etc. Different concepts imply different objectives, operational characteristics and system boundaries. For example, „industrial ecosystems“ enhance the analogy to natural ecosystems, „industrial symbiosis“ gives attention to symbiotic and synergistic linkages between companies whereas „eco-industrial networking“ emphasizes cooperation and can sometimes be used as an umbrella term for a number of concepts. „Eco-industrial parks“ can also be seen as a form of symbiotic industrial relationships (Chertow, 2000).

Eco-industrial parks can be best defined as a community in cooperation and interaction, efficiency in the use of natural resources and through its system view (Cote and Cohen-Rosenthal ,1998:pp.181-188).The environmental impact is reduced at a regional level, not only separately in individual companies. Industrial symbiosis engages traditionally separate industries in a collective approach to a competitive advantage involving a physical exchange of materials, energy, water, and by-products (Chertow, 2000). New unexpected connections between diverse types of industries or even outside industrial production can occur in eco-industrial parks thanks to the physical proximity of the actors (Heeres et al, 2004:pp.985-996).

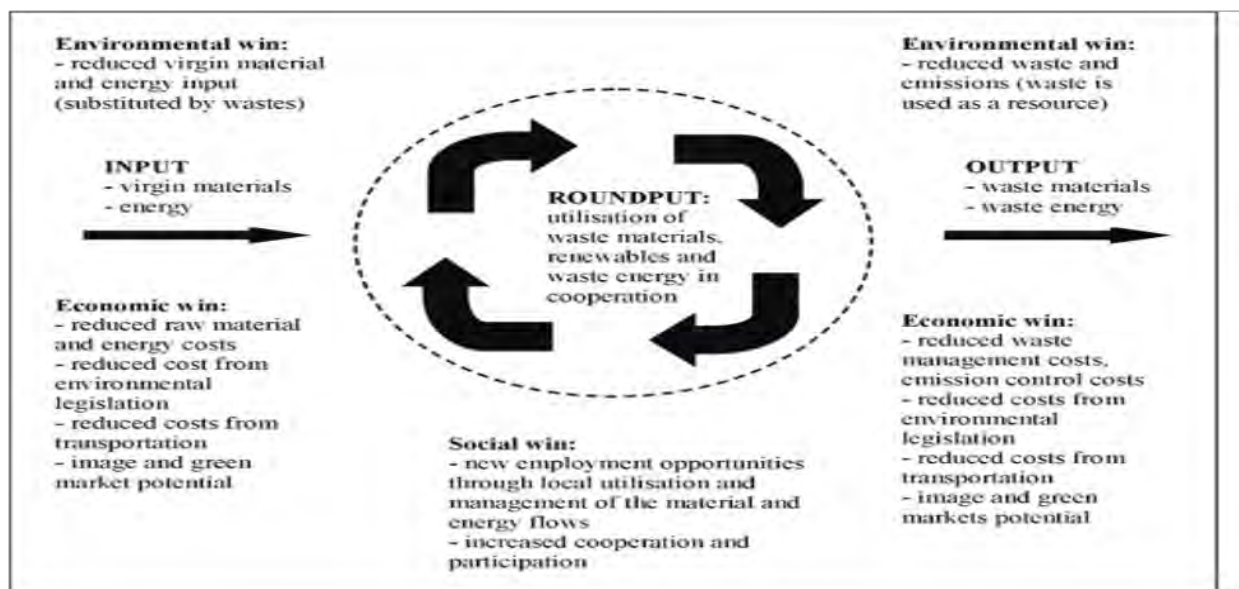
The EIP can be also defined as follows;

“An eco-industrial park is a community of manufacturing and service businesses located together on a common property. Member businesses seek enhanced environmental, economic, and social performance through collaboration in managing environmental and resource issues. By working together, the community of businesses seeks a collective benefit that is greater than the sum of individual benefits each company would realize by only optimizing its

individual performance. An eco-industrial park also looks for benefits for neighboring communities to assure that the net impact of its development is positive.” (Lowe, 2001)

Eco-industrial parks aim at achieving economic, environmental and social benefits. Eco-industrial parks seek to increase business competitiveness. Reduced raw material, waste, energy and emission control costs reduce the costs of companies. Compared with more wasteful competitors, a higher environmental and business performance is a way of achieving cost competitiveness and business advantages. Consequently, seeking competitive advantages is one of the main reasons for companies to want to engage in eco-industrial park networking. Networking may provide companies with competitive advantages mainly by giving them access to critical resources and by allowing for cost savings and inter –organizational learning (Starlander ,2003). There are also benefits based on nonmaterial linkages like transportation networks, sharing offices and information, and security services (Chertow, 2000). Eco-industrial parks use resources effectively and are flexible actors in the market. Networks usually adapt flexibly to strain and change. They are organized to use information and resources optimally.

Figure 2:-Environmental, economic and social „wins“ related to material and energy flows in the vision of a successful EIPs



Source: REGIONAL COUNCIL OF ETELÄ-SAVO

2.2. Policy and legal framework for environmental management

2.2.1. The constitution of Ethiopia

The constitution of the Federal Democratic Republic of Ethiopia provides the overriding principles for all legislative frame-works in the country. The concept of sustainable development and the environmental rights of the people are protected in the constitution by articles that stipulate the rights of peoples in the country. The concept of sustainable development and environmental rights are enshrined in article 43, 44 and 92 of the Constitution (FDRE, 1995)

Article 43 of the constitution also speculates “The Right to Development” which identifies peoples' right to improved living standards and to sustainable development; and participate in national development and, in particular, to be consulted with respect to policies and projects affecting their community. Similarly, according to Article 44; Environmental Rights, all persons have the right to a clean and healthy environment; and who have been displaced or whose livelihoods have been adversely affected as a result of State programs has the right to commensurate monetary or alternative means of compensation, including relocation with adequate State assistance.

Moreover, in Article 92: Environmental objectives are identified as,

“Government shall endeavor to ensure that all Ethiopians live in a clean and healthy environment, the design and implementation of programs shall not damage or destroy the environment, people have the right to full consultation and to the expression of views in the planning and implementation of environmental policies and projects that affect them directly and Government and citizens shall have the duty to protect the environment” (FDRE, 1995).

2.2.2. Environmental policy of Ethiopia

The Environmental Policy of Ethiopia was approved in 1997 and is the first key document that captured environmental sustainable development principles. The goal of the Environmental Policy of Ethiopia is to improve and enhance the health and quality of life of all Ethiopians and

to promote sustainable social and economic development through the sound management and use of resources and the environment as a whole so as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs (EPA, 1997).

For the effective implementation of the Environmental Policy of Ethiopia, the policy encourages creation of an organizational and institutional framework from federal to community levels. The Environmental Policy of Ethiopia provides a number of guiding principles that require adherence to principles of sustainable development; in particular, the need to ensure Environmental Impact Assessment. It considers impacts on human and natural environments, provides for early consideration of environmental impacts in projects and programs design, recognizes public consultation, includes mitigation and contingency plans, provides for auditing and monitoring; and is a legally binding requirement (EPA, 1997).

2.2.3. Ethiopia's climate resilient green economy strategy

To cope with the prevailing environmental problems such as land degradation and other climatic hazards (rainfall fluctuation, increasing temperature, flooding), and speed up its socioeconomic development, the Government of Ethiopia has initiated climate-resilient green economy as a development strategy in 2011. This development direction promotes environmental protection, reducing fossil fuel consumption which releases greenhouse gases into the atmosphere. With demand for energy growing with the increasing population, industrialization and urbanization, the Government realized that harnessing clean and renewable energy sources such as wind, solar, hydro and geothermal energy sources was critical. It has indicated that these natural resources would deliver electricity at virtually zero GHG emissions. The generated electricity is a fundamental enabler of modern economic development, from powering cities and fuelling industrial activity to pumping water for irrigation purposes in agriculture. The Government also decided to increase its income through exporting electric power generated from clean sources to neighboring countries (CREGS, 2012).

Ethiopia has the ambition to develop along a green economic trajectory. It has consequently outlined a strategy to build this green economy. So far, it has identified and prioritized more than 60 initiatives that could help the country to achieve its economic development goals while at the same time limiting net GHG emissions in 2030 to below today's 150 Mt CO₂e – around 250 Mt CO₂e less than estimated for the current development path . Building a green economy will lead to further socio-economic benefits and allow Ethiopia to tap climate finance (CREGS, 2012).

2.2.4. Establishment of Environmental Protection Organs

Proclamation 295/2002 establishes the organizational requirements and identifies the need to establish a system that enables coordinated but different responsibilities of environmental protection agencies at federal and regional levels. The Proclamation indicates the duties of different administrative levels responsible for applying federal law. Depending on the decisions made, resources available and specific organizational situation in each Region, Regional States have devolved duties and responsibilities to woredas and kebeles.

Participatory process of making the country's economy green and climate change resilient was initially planned to be undertaken under the ownership of the then EPA. However, such effort did not receive the necessary attention either at the federal or regional level thereby necessitating the establishment of the new Ministry. AS a part of the effort to realize the government's Climate Resilient Green Economy strategy, the former EPA has been upgraded into MoEF in 2013.

2.2.5. Environmental Impact Assessment

The Federal Government has issued a Proclamation on Environmental Impact Assessment, (Proc, 299/2002) and the primary aim of this Proclamation is to make EIA mandatory for specified categories of activities undertaken either by the public or private sectors, and possibly, the extension of EIA to policies, plans and programmes in addition to projects.

The provisions of the proclamation include; projects will be subject to EIA and execution is subject to an environmental clearance from the former EPA or Regional Government

Environmental Agency, as applies; EPA or the Regional Agency depending on the magnitude of expected impacts, may waive the requirement of an EIA; All other licensing agencies shall, prior to issuing of a license, ensure that either EPA or the regional Environmental Agency has authorized implementation of project; a licensing agency shall either suspend or cancel a license that has already been issued, in the case that EPA or the Regional environmental agency suspends or cancels the environmental authorization; and approval of an Environmental Impact Study Report (EISR) or the granting of authorization by the EPA (Proc, 299/2002).

2.2.6. Environmental Pollution Control

Proclamation No. 300/2002 on Environmental Pollution Control primarily aims to ensure the right of citizens to a healthy environment and to impose obligations to protect the environment of the country. The proclamation is based on the principle that each citizen has the right to have a healthy environment, as well as the obligation to protect the environment of the country. The law addresses the management of hazardous waste, municipal waste, the establishment of environmental quality standards for air, water and soil; and monitoring of pollution. The proclamation also addresses noise and vibration as one source of environmental pollution and it seeks for standards and limits for it providing for the maximum allowable noise level taking into account in the settlement patterns. In general, the Proclamation provides a basis from which the relevant environmental standards applicable to Ethiopia can be developed, while sanctioning violation of these standards as criminally punishable offences.

Furthermore, it empowers the EPA and/or the Regional Environmental Authority to assign environmental inspectors with the duties and responsibilities of controlling environmental pollution. In order to ensure implementation of environmental standards and related requirements, inspectors belonging to the EPA or the relevant regional environmental agency are empowered by the Proclamation to enter, without prior notice or court order, any land or premises at any time, at their discretion.

2.2.7. Solid Waste Management

Proclamation no. 513/2007 aims to promote community participation in order to prevent adverse effects and enhance benefits resulting from solid waste. It provides for preparation of solid waste management action plans by urban local governments.

Therefore, Solid Waste Management Proclamation No. 513/2007 states (Article 5.1) that Urban Administrations shall ensure the participation of the lowest administrative levels and their respective local communities in designing and implementing their respective solid waste management plans. In Article 5.1 each Region or urban administration shall set its own schedule and, based on that, prepare its solid waste management plan and report of implementation. Further information on preparation and implementation of solid waste management plans may be obtained from the Regional Environmental Protection Authorities and federal EPA. Measures related to waste handling and disposal. According to this proclamation, any person shall collect waste in an especially designated place and in a manner, which does not affect the health of the society and no person shall dispose solid, liquid or any other waste in a manner which contaminate the environment or affects the health of the society.

2.2.8. Prevention of Industrial Pollution Regulation

As a follow up to Proclamation 300/2002, a regulation to prevent industrial pollution was developed by the Federal Environmental Protection Authority and endorsed by the Council of Ministers to ensure compatibility of industrial development with environmental conservation.

This Regulation confers important obligations to industrial operators. A factory subject to the regulations is obliged to prevent or minimize the generation and release of pollutants to a level not exceeding the environmental standards. The regulation also obliges industrial operators to handle its equipment, inputs and products in a manner that prevents damage to the environment and to human health. Moreover, the regulations urge industrial operators to prepare and implement an emergency response system of their own. On the other hand, industrial operators are required to prepare and implement internal environmental monitoring systems and keep written records of the pollutants generated and the disposal mechanisms used to get rid of the pollutants. In relation to it, factories are required by the regulation to submit annual compliance reports with the provision of the regulations (**Regulation 159/2008**).

2.2.9. Labour Proclamation

The Labour Proclamation which was revised in 2003 provides the basic principles which govern labour conditions taking into account the political, economic and social policies of the Government, and in conformity with the international conventions and treaties to which Ethiopia is a party. The proclamation under its Part Seven, Chapter One, Article 92 of this proclamation deals with Occupational Safety, Health and Working Environment, Prevention Measures and Obligations of the Employers. Accordingly the Proclamation obliges the employer to take the necessary measure for adequate safeguarding of the workers in terms of their health and safety (Proclamation 377/2003). Moreover, the Occupation Health and Safety Directive (MOLSA, 2003) provides the limits for occupational exposure to working conditions that have adverse impacts on health and safety.

Despite the above proclamation there is still considerable issue regarding to the relationship between employers and workers for issues such as wage, safety and other benefits. The former complains that this law opens window for inefficiency and tilted to the workers because they can make their case to the court. On other hand still employees have dissatisfaction on benefit package and other rights.

2.2.10. Public Health Proclamation

The Public Health Proclamation (200/2000) comprehensively addresses aspects of public health including among others, water quality control, waste handling and disposal, availability of toilet facilities, and the health permit and registration of different operations. The Proclamation prohibits the disposal of untreated solid or liquid hazardous wastes into water bodies or the environment that can affect human health.

2.2.11. Sectoral environmental policies

Sectoral policies have been prepared by various agencies. The Federal Water Resource Policy formulated by the former Ministry of Water Resources (nowadays restructured to be the Ministry of Water and Energy) advocates comprehensive and integrated water resource management. The overall goal of the policy is to enhance and promote all national efforts

towards the efficient and optimum utilization of the available water resources for socio-economic development on a sustainable basis.

2.2.12. Environmental guidelines and standards

During 2008 – 2010 EPA had prepared draft environmental standards for several industrial sector activities and ambient environmental qualities. During the same period, the EPA also prepared several draft guidelines that includes the draft Guideline on Sustainable Industrial Zone/Estate Development. Few years back, the Environment Council, which is a higher body with a mandate to endorse guidelines, have selectively accepted the industrial environmental standards for twelve specified industrial sub-sectors. The accepted industrial emission standards include Tanning and leather finishing, Manufacturing and finishing of textiles, pharmaceutical manufacturing etc.(MoI,2012)

In general starting from the constitution to different law Ethiopia in corporate useful environmental laws this is a positive step in applying the environmental policy and laws, however additional policy instruments and mechanisms are required to in force the above law. Sector oral approaches should be used to study the binding constraints in implementing Environmental policy, laws and standards. There are serious weaknesses in the use of the strategy of environmental policy integration in industrial sector especially the tanning area as a tool for the promotion of sustainable development (Baker, 2006).

For example issue of implementation of environmental standard for tanning industry is quite different for food industries, i.e. Sector specific strategies should be designed to make environmental policy practical. In addition laws which motivate enterprises in the form of tax or cost sharing shall and other innovative tools should be formulated to address the cost of using ETP and installations for keeping the environment clear.

As cited by zelege (2011), Gashaw (2007) tried to pinpoint that, tanneries should select key strategy to maintain achievement and enhance its performance that extends beyond compliance in promoting EMS in general in tanning process, transfer technological and eco-friendly management practice. According to him, the tanneries development path way should comply

with five pillars of sustainable development; - ecologically protective, socially acceptable, economically productive, and environmentally just and efficient.

2.3. Empirical literature review

According to the 1996 report by Ministry of Health on the study of liquid waste management, out of 118 industrial establishments assessed in the city of Ethiopia, 40 have solid waste discharges, 61 generate air pollutant discharges while 62 generate liquid wastes that are discharged to the surrounding. Only 6 out of the investigated factories are found to have some form of wastewater treatment plants and the rest discharge their wastes without any form of treatment (UNESCO, 2004).

The first action for limiting the environmental impact of the tanning industry in Ethiopia started in 1986 when the previous National Leather and Shoe Corporation purchased from Italy the equipment for two effluent treatment plants to be installed at Modjo and Combolcha tanneries. The two plants should be an example for the national industry, providing experience and training to be disseminated throughout the country. Because of the high cost of the ancillary civil works, the equipment installation was delayed, and in 1990 the National Leather and Shoe Corporation contacted UNIDO for assistance. A new design of the civil works has been prepared using local available building materials (stones) and less expensive construction systems. (Favazzi, A, 2003),

The issue of cost of ETP is one of the challenges to use primary, secondary and tertiary effluent treatment plants effectively. The following sections discuss best practices that could be taken as lesson in making environmental policy practical. Selected country experiences are forwarded for this purpose.

2.3.1. India

In India, till 1990, only one CETP at Jeedimetla, Hyderabad was in operation. In 1991, the Ministry of Environment & Forests, Government of India initiated an innovative financial support scheme for CETPs to ensure the growth of the small and medium entrepreneurs

(SMEs) in an environmentally compatible manner (MoEFI, 2010). The provision of the scheme for fund support is as follows:

- State Government subsidy- 25% of the project capital cost
- Central government matching grants-25%
- Loans from financial institutions- 30% of the project capital cost, and
- Contribution from the SMEs- 20% of the project capital cost

While this scheme is designed for an initial period of 10 years, considering the need was extended further. Besides, the MoEFI, the Ministry of Commerce and other funding schemes supported establishment of new CETPs and augmentation of the existing ones. The concept of CETP was adopted to achieve end-of-the-pipe treatment of combined waste water to avail the benefit of scale of operation. In addition, the CETP also facilitates in reduction of number of discharge points in an industrial estate for better enforcement and also to make the skilled man power available for proper treatment of effluent (MoEFI, 2010)

A total of 130 CETPs have come-up in the country, either established or in the process of establishment, to cater to the needs of the industrial clusters/group of industries of which, 91 CETPs are in operation. **(MoEFI,2010)**

In Chennai and Tamil Nadu/India, which was the basis for demonstration of UNIDO regional projects, circumstances at the time of project (mid 90's) commencement were such that the tanning Industry was under considerable pressure vis-à-vis effluent treatment. As a result, several tanneries or clusters had already undertaken investments in primary or secondary effluent treatment. Rather than create a possible redundant model plant, the project strategy was oriented towards demonstration of four full scale model effluent treatment plants representing different aspects of tannery effluent treatment plant in terms of influent, treatment process and size. Thus, the Ranitec CETP with treatment capacity of 4,000 m³/d receiving effluent from 76 tanneries processing from raw to finished and using amongst others an anaerobic treatment system (lagoon) was upgraded to serve as a model for similar treatment plants in the region. The Vishtec CETP with a capacity of 3,400 m³/d of effluent using two stage aerobic treatment system was upgraded (mainly process control) to be a second model site. The President Kid Leather Company ETP, 120 m³/d receiving effluent from semi-finished to finished tanning processes from an isolated was upgraded as a model site (automatic dosing,

laboratory). The MHT Company ETP, capacity 100 m³/d, receiving effluent from a traditional isolated vegetable tannery, a low cost anaerobic treatment system, was upgraded and serves as a model for similar units. (MoEFI,2010)

Picture 1:- CETP, VISHTEC, Melvisharam, India



Source: UNIDO leather panel.org

2.3.2. Italy

Italy is known for its fashion leather and leather products. Due to environment concern and economic benefit the country designs leather industry clusters and related industries to be settled in cluster one of the best examples is “The leather district of Santa Croce sull’Arno”. It comprehends 6 municipalities: 5 in the province of Pise (Santa Croce sull’Arno, Castelfranco di Sotto, San Miniato, Montopoli, and Santa Maria a Monte) and 1 in the province of Florence (Fucecchio) (Favazzi.A, 2003).

The population of the district is around 90,000 people. This is one of the most important areas for the leather industry in Italy and the world, and leather sector is the main component of the local productive system and economy. The leather activity employs about 10,000 persons in about 450 tanneries of different sizes, and 400 allied industries. Four common effluent treatment plants, Aquarno, Cuoiodepur, Consorzio Conciatori di Fucecchio, and Castelfranco

di Sotto, have been implemented for treating the waste waters generated from the district and one joint Chrome recovery plant, Consorzio Recupero Cromo. According to Favazzi(2003) ,the following integrated activities are performed in this district:-

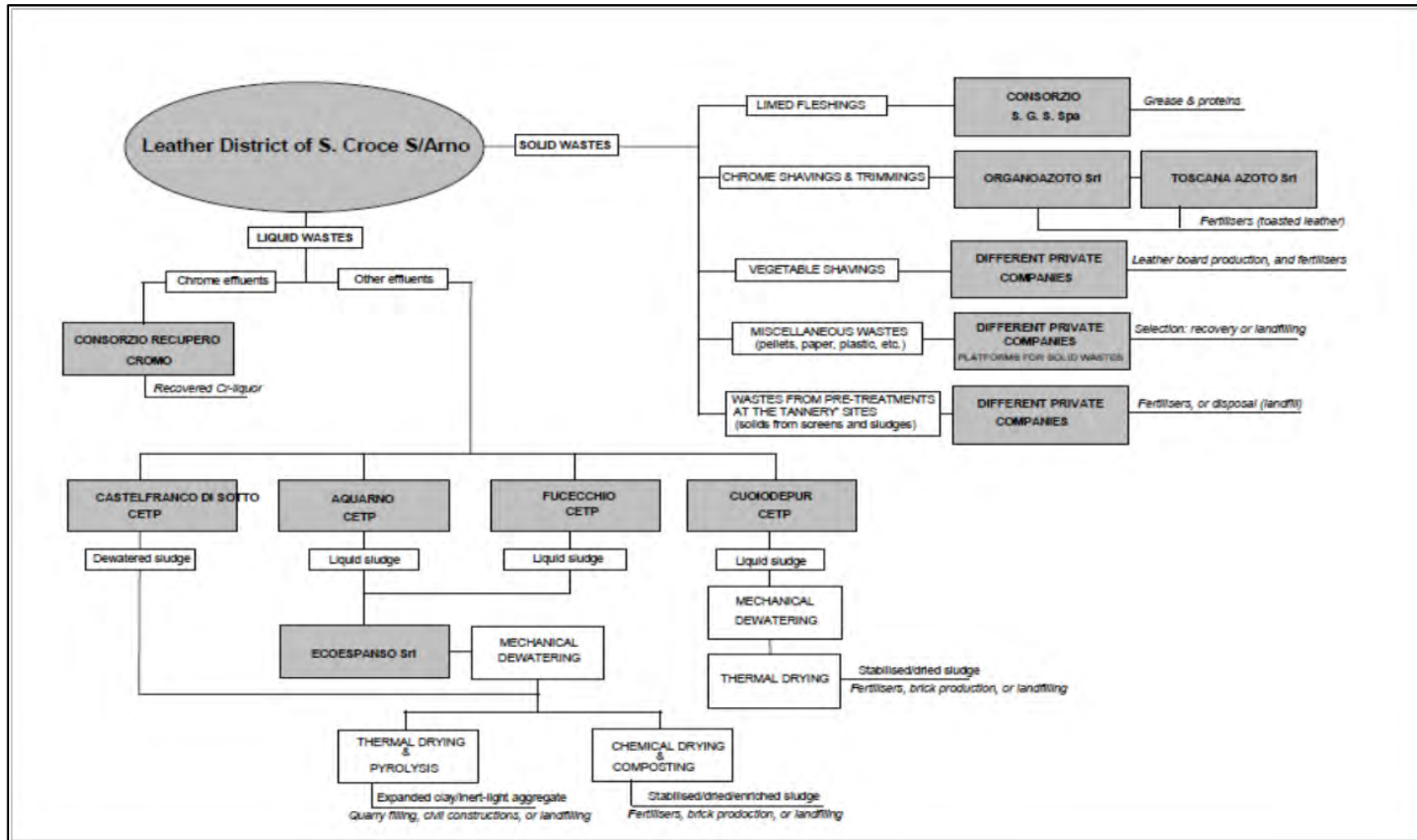
- The Consorzio SGS collects all the fleshing of the district producing and marketing grease and proteins for animal food and fertilizers.
- One company Ecoespanso takes care of the collection, treatment and disposal of the sludge generated by the three CETPs located at the right side of Arno River: Aquarno, Consorzio Conciatori di Fucecchio, and Castelfranco di Sotto.
- The Consorzio Impianti Smaltimento (CIS) manages the final operation and monitoring of 4 filled landfills for tannery sludge no more used.
- Two private companies Organoazoto and Toscana Azoto collect and make fertilizers from the chrome shavings and trimmings.

From the above measures, India`s and Italy`s empirical literature review, we can learn the following important lessons:-

- ❖ The importance of Government interventions and facilitation to decrease the cost of treating waste disposal from tanneries by Establishing CETP.
- ❖ By clustering and integrating Tanneries and other enterprises which uses the discharge of tanneries it is possible to create an Eco- Industrial park which is Eco-friendly to the environment.

In general, the importance of practical measures to environmental policies and regulations are important practical lesson from the two countries. The following figure shows Santa Croce sull'Arno district and the chain relationship between different enterprises in the district.

Figure 3:- Leather District of s. Croce S/Arno diagrammatic representation of Solid and liquid wastes



Source:(Favazzi.A,2003).

2.4. Conclusions

This chapter discussed various conceptual frame works about the tanning industry, its consequence on health and the environment .Tanning industry will have devastating effect on human beings and animals as well as on the general eco-system, especially if the waste discharged for this industry is not properly managed.

These days tanneries are confronted to meet the standard and guide lines of environmental law, hence it would be required to use cleaner technologies. Physical- chemical treatment (primary), Biological treatment (secondary) and Advanced (treatment) are different phases of treating the waste from tannery. There is complexity in technology as we move from primary ETP to tertiary ETP.

From this chapter it is recognized that the government of Ethiopia formulated environmental policy and a number of laws for its implementation. Starting from the constitution, there are several proclamations, regulations, standards and guide lines for implementation of the policy. However, there is less integration between these laws and the industrial policy. Though the initiative of CRGES in 2011 is one step forward, in general there has been lack of additional policy instruments and innovative practical mechanisms which result in weak implementation in the environmental policy.

This chapter finally presents empirical literature review by including the best practices of countries, i.e. India and Italy, to implement environmental laws and regulations. From the experience of these two countries, we can realize that it would be better to cluster tanneries in one area and use CETP. To this end, practical the role of government is crucial in establishing the CETP infrastructure, establishing Eco- Industrial parks for tanneries with CETP helps in minimizing the cost of treatment also helps in recycling energy between different factories so that profitability of the tanners will not be affected and at the same time environmental sustainability issue will be addressed.

CHAPTER THREE

3. DATA DESCRIPTION

Data should be appropriately compiled and described in order to make further analysis; hence different data from the survey are described using tables and graphs. For these purposes presentations of background of HAFPLC, respondents of the survey questionnaires and interviewee are followed by detail data description of the responses obtained from the survey questionnaires.

3.1. Background of HAFPLC

HAFPLC is a private limited company established in 1995, located at Sebta town's municipality about 25Km from Addis Ababa along the main road of Alemgena, in Ethiopia. It is a private limited company situated in Ethiopia. This Tannery is built along Sebta River which is one of tributaries of the Awash River.

HAFPLC has a capacity of processing 7500 pieces of skins and 200 pieces of hides per day. The tannery is processing hides and skins in a series of processing machineries in the same compound.

The company's achievement of targets set are: improving the quality of HAFPLC's products, improving productivity to meet international standards, searching new markets, having quality certificate both on management and environment.

The tannery is selling its products to the local and export markets. HAFPLC is one of the major exporting tanneries to the international market. In 2012/2013, it exported finished leather worth of 1.5 million USD (LIDI, 2013).

3.2. Background of the respondents of the survey questionnaires

The respondents of the survey questionnaires were categorized into three groups, i.e. production and quality heads shift leaders and supervisors, Machine operators and casual workers.

The sample size for the survey was 74, which is believed to be representative of the total population of 250 workers during the field survey. Two respondents eliminated later because of the facts they do not properly filled the questionnaires.

Table 1:-Sex distribution of the respondents

Sex	Male	Female	Total
Size.	62	10	72
%	86	14	100

Source: From own field survey, in November 2014.

As shown on table 1, among the respondents 10 were female and the 62 were male .This indicates tha14% of the respondents of the survey questionnaires are female and 86% of them are male.

Table 2:- Education level

Education level	≤ Grade 10	TVET /Diploma	BSC	MA above
Size	42	20	10	N0
%	58	28	14	

Source: From own field survey, in November 2014.

Regarding the educational level of respondents, 58% are up to grade 10, 28% are TVET graduates/Diploma, while14% BA/BSC Degree. There is no respondent was found to have post graduate degree above as presented on table 2.

Table 3:- work experience

Education level	less than five Years	five to ten years	Greater than ten years
Work experience	16	33	23
%	22	46	32

Source: From own field survey, in November 2014.

Regarding to the experience of the respondent, 22% of theme have less than 5 years, 46% have 5 to 10 Years, and 32 % have above ten year experience as shown on table 3. The data from the education experience and education level of the respondent implies most HAFPLC workers doing by their virtue of experience rather than academic level.

3.3. Back ground of the interviewees

Table 4:-Institutions of key interviewees and their responsibilities.

No.	Institutions	Responsibilities of interviewees
1.	ELIA	Association Vice president
2.	MoI	Industry zones and Environment Team Leader
3.	MoEF	Legal enforcement senior Expert
4.	ORLEMB	EIA specialist
5.	STEO	Environmental Impact monitoring and Evaluation specialist/acting STO head
6.	LIDI	Environment Team Leader.

Source: From own field survey, in November 2014.

In order to have full understanding of the research issue interviews were conducted with key respondents, i.e. with one Association vice presented, with one official, two team leaders, one expert and one specialist form ELIA, STO, MOI, LIDI, ORLEMB and MoEF respectively as shown in table 4. Similarly FGD, were made with seven individuals who were community leaders of Roge village during the survey to get addition information of the research questions. The information obtained from the interviews and FGD will not be separately presented rather they will be used to supplement the data obtained from the survey questionnaires.

3.4. Description of the responses for survey questionnaires

Totally 74, questionnaires were distributed to the respondents systematically and randomly. All questionnaires were appropriately filled except 2questioneries which were not appropriately filled .They were rejected as a result.

Table 5:- Response on the application of Industrial pollution standards and ETP.

ETP	
To protect the environment	90%
To avoid penalty	9%
Do not have any idea	1%
Application of Industrial pollution standards by HAFPLC	
Agree	40%
Strongly agree	58%
Disagree	2%

Source: From own field survey, in November 2014.

For contribution of the sustainability of the tanning industry first proper conception of environmental sustainability is required. In order to know the respondents' attitude regarding to environmental protections, questions related to this issue were raised by the researcher. When respondents asked about the purpose of using ETP, as shown on table 5, majority of respondents, i.e. 90% of them replied using ETP is primarily for the sake of protecting the environment while 9% of the respondents said to avoid penalty and 1% of them replied they have no any idea. On the other hand asked about the responsibility of HAPLC implementation of Industrial pollution standards set to the tanneries, 40% of respondents agree the tannery should apply it while 58% of the respondents strongly agree and only 2% replied their disagreement.

Table 6:-Response about the odor from the tannery

Not comfortable	74%
Strongly not comfortable	7%
Not affecting	19%

Source: From own field survey, in November 2014.

Another point raised to know their conception on the environment is the issue of bad odor from the tannery. Table.6. depicts the feeling of workers about the odor from the tanneries, 74% of respondents replied they are not comfortable; while 7% are strongly not comfortable, and 19% confirmed that is not affecting them.

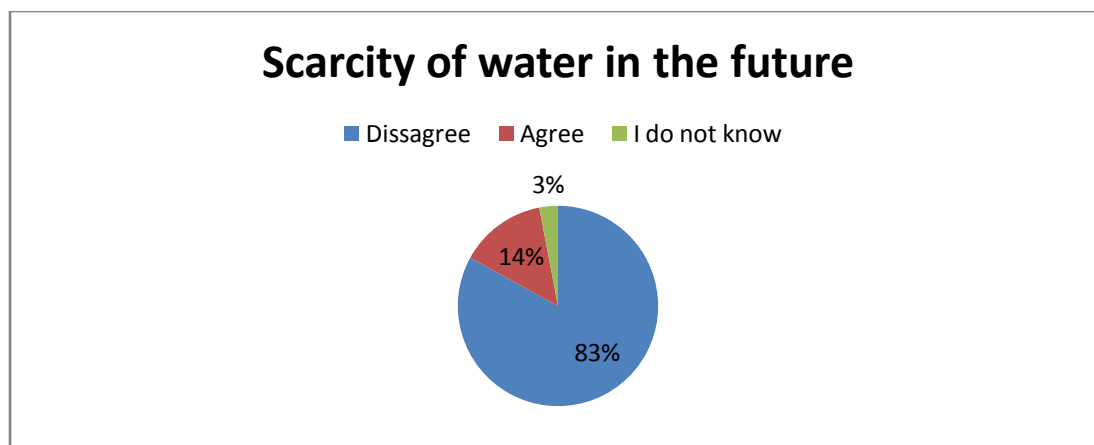
Table 7:-Response on the source of water

Ground water	87%
Rain water	4%
Municipal water	6%
Not sure	3%

Source: From own field survey, in November 2014.

Usually, tanneries use water extravagantly if it comes from cheap ground water. In relation to this when respondents asked about the source of water used by HAFPLC; as shown on Table .7, majority of them, i.e. 87% responded the tannery uses ground water, 4% replied it uses rain water, and 6% responded municipal water and 3% were not sure.

Figure 4:-Response on scarcity of water in the future



Source: From own field survey, in November 2014.

Another point raised to the respondents to evaluate their concept of sustainability was their thinking about the scarcity of water. Figure 4 portrays responses on whether or not water will be scarce in the future, in which majority of the respondents, i.e. 83% disagree on the grounds that water will be scarce in the future while 14% agree it will be scarce and 3% of them they do not have any idea.

Table 8:-Response on Hides pre- cleaning and water usage.

Hides pre-cleaned	
Disagree	65%
Agree	35%
Water pretreated	
Agree	10%
Disagree	70%
Strongly disagree	20%
water was left running between production stage	
yes	93%
No	7%

Source: From own field survey, in November 2014.

Using cleaner technologies and methods helps in minimizing the waste discharge from tanneries .For the question presented to respondents “are Hides pre-cleaned in HAPLC before entering to the tanning process?”, 65% replied they disagree to the idea that hides are pre-cleaned and 35% of theme agree this process is taking place in the tannery as shown on table 8. Similarly, regarding the issue of whether or not water for the tannery processing is treated, 10% of the respondents agreed that it is pretreated, while 70% of them disagree and 20% of the respondents strongly disagree. On the other hand, when asked about whether or not water is left running between production stages 93% of respondents replied “yes”, while only 7% of them responded “No”.

Table 9:- Response on application of environmental guidelines to tanneries.

Strongly agree	40%
disagree	50%
Strongly disagree	5%
No idea	5%

Source: From own field survey, in November 2014.

Regarding the application of environmental guidelines to Tanneries by HAFPLC, from table .9 we can see that 40% of the respondents strongly agree, while 50% of them disagree and 5% of them strongly disagree and the rest have no idea, whether HAFPLC applies or not environmental guidelines to Tanneries.

Table 10:- Response on treatment of waste

Discharges waste directly to river	21%
Discharges waste to the soil	7%
Discharges waste to the river through ETP	72%

Source: From own field survey, in November 2014.

To know the application of ETP by HAPLC question related to it was raised during the survey. As shown on table 10, 21 % of the respondents replied it discharges waste directly to the river, while 7% of them responded directly to the soil and majority of them, i.e. 72% replied it discharges to the river through ETP.

Table 11:-Response on the usage of sludge disposal site.

Dose HAPLC has sludge disposal site?	
Agree it has sludge disposal site	92%
Disagree	8%
Is the site is free from other environmental threat?	
Agree	32%
Disagree	68%

Source: From own field survey, in November 2014.

Concerning about the presence of sludge disposal site in HAFPLC, 92% agree it has sludge disposal site, 8% replied disagrees, however 68% of the respondents disagrees the site is free of another environmental treat as shown on Table .11.

Table 12:-Response on the presence of environmental control action plan

Agree	95%
Disagree	5%

Source: From own field survey, in November 2014.

When respondents were asked about whether there is environmental control action plan or not in HAFPLC to implement environmental guide lines and regulation, from table, 95% of theme agreed to the presence of environmental control action plan in this tannery and the reaming disagreed as shown on table 12.

Table 13:- Response on knowledge of chemicals.

Do you know kinds of chemicals used in tannery production process dissolved in water?	
yes	47%
No	53%
Can you tell the most toxic chemical composing the waste water in the tannery?	
yes	31%
No	69%

Source: From own field survey, in November 2014.

When respondents asked about their knowledge of chemicals used in tannery production process dissolved in water, 53% of replied “yes” and the reaming 47% informants replied “No”. Similarly when respondents are asked whether or not could tell the most toxic chemical used in

the tannery, 69% of them replied that they could not tale about this chemical while the reaming 31% believes they can tell this chemical as shown on table 13.

Table 14:-Response on training about safety and environmental protection.

Do you take training about safety and environmental	
Agree	51%
Disagree	49%

Source: From own field survey, in November 2014.

Training for employee of a factory on safety and environmental protection is essential for wellbeing of the workers and take caring the environment. As shown on table 14. , When respondents asked about whether or not they took training about safety and environmental protection, 51% of them agree they took such kind of training in one form another, however still considerable amount of respondents, i.e. 49% do not take such kind of training.

Table 15:-Response on tanning process taking much water and chemical

Beam housing	61%
Tanning	7%
Finishing process	72%

Source: From own field survey, in November 2014.

Knowing properly the step of the tanning process taking much water in HAFPLC helps in recommending measure to be taken in the future thereby decreasing waste discharged from the tannery. As shown on table .15, 61% of the respondent replied the beam housing step uses a lot of water and chemical while 21% of the informants replied Tanning process and 18% replied it is the finishing process.

Table 16:- Response on standardization and checking for the accuracy of weighing materials

Frequently checked	61%
sometimes	30%
Not at all	53%

Source: From own field survey, in November 2014.

The standardization and checking for the accuracy of weighing materials is very important step to ensure whether or not appropriate amount of inputs are used in the processes of tanning. When respondents asked how much these materials are checked in HAFPLC, only 17% of the informants replied they are frequently checked, while 30% said sometimes, while 53% responded not at all as shown on Table .16.

Table 17:-Response on sufficiency of chemical monitoring unit

Agree	41%
Disagrees	47%
Strongly disagree	12%

Source: From own field survey, in November 2014.

The sufficiency of chemical monitoring is very critical because it affects the quality of tanning and the amount of chemical used in the tanning process. As shown on table .17.respondents responses on the sufficiency of chemical recipe monitoring system installment in the tannery are,41% of theme agree it is sufficient while47% disagrees and 12% of the respondents replied strongly disagrees.

Table 18:- Response on the risk of chemical contamination

Less risk	59%
Sometimes there is risk	27%
There is always risk	14%

Source: From own field survey, in November 2014.

Storage, disposal and handling mechanisms of chemical are important factors in relation to the risk of contamination. Table .18.shows the response of workers to the risk of chemical contamination, 59% of the respondents replied there is less risk while 27% of them replied sometimes there is risk and 14 % of the informants said there is always risk.

Table 19:-Response on the effort of HAFPLC to workers health and working condition

making strong effort	11%
Making some effort	58%
is not making any effort	31%

Source: From own field survey, in November 2014.

The overall factory operating condition will affect the wellbeing of workers. From table .19 we can see 11% of the respondents replied HAFPLC is making strong effort, while 58% of the informants responded it is making some effort while 31% theme replied it is not making any effort to the wellbeing of workers health and working condition.

Table 20:- Response on factory lay out

Agrees	52%
disagree	48%

Source: From own field survey, in November 2014.

The engineering and lay out has contributions whether or not there is proper sludge and waste disposal inside a tannery. As shown on table. 20 when the respondents asked about whether the tannery structure well installed to let efficient wastewater out flow under the floor, 52% of them agree, while 48% disagree it has this appropriate layout.

Table 21:-Response on the challenges of using ETP

Finance	31%
knowledge	21%
Both	48%

Source: From own field survey, in November 2014.

Finance and skill of operation are the main factors for running ETP. To know how much HAFPCCL is constrained by these challenges question related to this issue was raised by the researcher. As shown from table .21. The response about the challenge of using ETP, 31% of the respondents replied Finance while 21 % of them said knowledge to use ETP and 48% of the informant replied both of them are challenges.

CHAPTER FOUR

4. DATA INTERPRETATION AND ANALYSIS

In this chapter, the data compiled and presented in Chapter three is interpreted and analyzed. The analysis is supported by the information obtained from the key respondents' interviews, focus group discussion and the observation made during the research. Data interpretation and analysis is synthesized under the thematic areas.

For this purpose data, information and observations related to conception of environmental sustainability, implementations and challenges of, environmental policy of Ethiopia, proclamations, regulations, environmental guidelines and standards in relation to the case study are interpreted and analyzed.

4.1. Conception about environmental sustainability

The HAFPLC respondents have good conception on the importance of obeying the environmental standards and guide lines, 90% of the respondents believe using ETP is primarily for the sake of protecting the environment and 58% strongly agrees implementation of Industrial pollution standards by HAFPLC (Table 5). These two facts shows most of the respondents have environmental concern.

Respondents have the understanding of the effect of the bad smell discharged to the environment, 74% of respondents are not at ease with the odor (Table 6). The key respondent from the tannery also understands the effect to the villagers but the problem is the cost and the technology of removing the bad odor from the waste. This could be interpreted as most of the employee understood the problem resulted from the tannery.

Haffed Tannery uses most of the time ground water and in relation to this, 83% of the respondents disagreed that water will be scarce in the future .This shows misconception as water as plenty of resource not recognizing even ground water could be depleted in the future, i.e. there is lack of environmental sustainability concept about water from the factory workers.

The MOI which was established to bring industrialization, by attracting investment, creating conducive environment and supporting the manufacturing industry to boost export, substituting import and job creation seems to be in delicate situation between the export from the tannery and their pollution. The key respondent from MOI acknowledges that there has been less environmental mainstreaming on plans and implementation especially before 2011, i.e. the launching of the CRGES. There is awareness by MoI future development of the manufacturing industry should address the issue of environmental issue and difficult to compete in the international market without addressing this issue. There is great emphasis for export issues, environment issues have been seen as supplementary to yearly annual plan. According to him, this is due to the eagerness from the government side to bring fast economic growth and there have been also resource and capacity limitations.

The key respondent from LIDI also gave similar response, in that LIDI as an institution which was established to support the leather industry in investment attraction, marketing, and technology transfer also faces two challenges. On one hand, the institute is expected to support the leather industry to reach 500 million USD export target by the end of 2014/2015; on the other hand, it has to work on the environment issues.

The ELIA which has the role of organizing leather and leather products enterprises also has similar understanding with MoI and LIDI, The position from the association is to take a balanced approach in dealing with the environmental issues related to the tannery. The key respondent from ELIA explained the position of the association is that environmental protection action should be practical according to the reality of Ethiopian tanneries, other wise it will be counterproductive for the survival of the weak tanning industry and the economic growth of the country.

From the above discussions, it becomes clear that the government badly needs foreign exchange and wants to bring speedy economic growth and it is not a matter of understanding, rather an issue of balancing between economy issue and the environment issues and their haven lack of innovative approach for the problem. On other hand, The “Roge” villagers have shown more

concern to the environmental issues during the course of FDG. They said that “we are not opposing the development endeavors and the investment themselves but factories should not let down to pollute our environment including HAFPLC”.

4.2. Implementation of environmental regulations and standards

Application of BAT is one way of reducing the waste discharge from the tanneries; however, HAFPLC is not practicing it well according to the respondents. For example 65% of them disagree hides are pre-cleaned in the tannery and 70% of them disagree on the pre-treatment of water (Table 8). On the other hand, when asked about whether water is left running between production stages, 93% replied “yes” (Table 8). All these data implies BAT is not applied appropriately in HAFPLC. Had it been practiced BAT, it would have been decreased the solid and Liquid discharged from it.

Regarding to the application of environmental guidelines to Tanneries and its applications by HAFPLC, 55% disagree (Table 9). On other hand, when the respondents were asked about the discharged from the tannery, 72% of them replied it discharges to the river through ETP (Table 10). These Data indicates the uncertainty of HAPLC in applying environmental regulations and standards set to tanneries adequately.

According to Environmental Pollution Control Proclamation No. 300/2002 and the regulation of Industrial Pollution, Industries, including tanneries, should have appropriate mechanism for not discharging hazardous chemicals to the environment. In relation to this tanneries are expected to have ETP. During the field visit it is observed that HAFPLC has primary ETP, but have no secondary and tertiary ETP.

Picture 2:-Some portion of HAFPLC ETP



Source: picture taken by the researcher during field survey on 11/12/2014.

However, during the interview with key respondent from ORLEMB, there is a problem in running ETP properly by this tannery and other tanneries also do not use even the primary ETP for not incurring the cost of treatment of the waste. This is also supported by the survey made by LIDI, that there are 14 tanneries having treatment infrastructure up to primary level, while most of them are not properly running their ETP (LIDI, 2013).

The Prevention of Industrial Pollution Regulation orders every industry including tanneries that they should have environment action plan to work on environment protection in accordance with this regulation. Regarding to this issue 95% of the factory respondents agree the presence of environmental control plan in this tannery and the remaining disagree (Table 12). This indicates at least on the paper, HAFPLC has action plan dealing with environmental issues. However, the key respondent, from ORLEMB responded that the issues are in the mind set of genuinely using the action plan strictly. The key respondent from the tannery acknowledges that he observes more strictness in applying the standards after the tannery was shut down for one month in 2013 by the Bureau.

All key respondents, including the FDG accept that there is improvement on complying with the environmental standard sets by MoEF. But the respondents who participated in the FDG are afraid the severe pollution effect that occurred before one year. The MoEF sets Environmental guidelines and standards to be followed by tanning industry. However, as table 22 indicates there were some gaps in meeting the standards of most parameters by HAFPLC especially in 2013.

Table 22:-Comparison of environmental regulation limits versus HAFPLC waste disposal.

Parameter	limit value	HAFPLC	Remark
Temperature	40°C	NA	
pH	6-9	7.87	in the limit
BOD ₅ at 20°C	200mg/l	361.54mg/l	Above the limit
COD	500mg/l	117.952mg/l	Above the limit
Suspended solid	50mg/l	1430.00mg/l	Above the limit
Total Ammonia (as N)	30mg/l	201.74mg/l	Above the limit
Total Nitrogen (as N)	60mg/l	239.8 mg/l	Above the limit
Total Phosphorus(as P)	10mg/l	4.55 mg/l	Bellow the limit
Oils, Fats and Grease	10mg/l	NA	
Mineral oils at oil trap or interceptors	20mg/l	NA	
Chromium as (total Cr)	2mg/l	33.40mg/l	Beyond the limite
Chromium (as Cr VI)	0.1 mg/l	NA	
Chlorides (as Cl)	1000mg/l	NA	
Sulphides (as S)	1mg/l	1.60	Beyond the limit
Phenols	1mg/l	NA	

Source; Researchers` own summary base on the data 2013 laboratory taste of STEO

From table 22 it is possible to see that the tannery was not using even its primary ETP treatment plant properly when the sample taken in 2013. The BODs and CODs were more than the minimum limit. The total Chromium (as Cr VI) maximum limit should not be more than 2mg/l, however at that time it was beyond the limit, i.e. 33.40. This shows the severity of the problem at that time. The key respondent from the tannery responded in line with this fact before the rehabilitation project of upgrading for HAFPLC, there was no chrome recycling at that time. During the field visit it was observed that additional safeguard measures are being taken. However, the tannery is not working at its full capacity (during the survey it was working bellow 50) due to working capital problem. Hence, there is no guarantee that if the HFAPLC works in

its full capacity to use primary treatment plant effectively. The key respondent from the tannery also shares this concern, i.e. if the tannery increases its production, it should increase the human resource and finance allocation for treating the waste.

From the conversation made with LID and ELIA association, Ethiopian tanneries could not use beyond primary and secondary treatment plant at this stage of development. By using reverse osmosis technology or membrane separator which has high operation cost and technological capability, that means it is the standard set for chlorides less than 1000mg/l is very difficult to be met by individual tanneries. Regarding water recycling, the key respondent from the tannery it was learned that this is impossible because of the fact that recycling water needs a lot of investment. In response, the best thing for the tannery is to use the cheap ground water. The key respondent from ELIA also supports this idea, i.e. it is very expensive investment to recycle water, and he said that “it is almost building another factory”. This shows almost the impossibility of water recycling mechanism due to cost factor with individual tanneries.

From the interview, LIDI respondent said that “we are still a poor country and if we use primary and secondary ETP, for the time being it is enough. When our economy is in advance in the future, we could use tertiary ETP to remove the salt and recycling the water”. Inorganic pollution is mainly made up by dissolved salts (chloride and sulphate), the removal of which has not been found out yet, unless the bearing of extremely high costs. Even the very sophisticated and expensive Italian treatment plants are unable to solve the problem of dissolved salts. Therefore, the limit of allowed quantity of such salts in the effluents has been increased or derogations to the national law were allowed (FAvaize, 2003)

Both key respondents for MoI and LIDI acknowledge that after the CREGE, there is more emphasis at least on setting the environmental issues. The key respondent from MoI mentioned that government is starting building Industry zones recognizing the current unplanned and scattered factories platform is difficult for controlling environmental pollution and other inefficiencies. The government is developing the Bole Leme Industry zone, also feasibility studies are undergoing to develop additional industry zones in Direhaw, Hawasa, Kombolcha. For the tanneries the government is undergoing feasibility studies to establish CETP in Mojo city according to the respondent from LIDI, selected tanneries including HAFPLC to be moved to

Mojo city. This indicates the beginning of streamlining of environmental issues by the government in practical terms. However, there is urgency to realize the feasibility studies in to projects.

Concerning about the presence of sludge disposal site of HAFPLC, 92% agree its presence, 68% of the respondents disagree the site is free of another environmental threat. This implies that the unsafe dumping of solid by the tannery which is in line with the observation made during the field visit. This problem is also shared by other tanneries , the solid waste(from production and sludge from ETP) management practices in most tanneries are not a good experience because most wastes are dumped on open areas , buried into a pit that are not well constructed and managed and burnt dry solid wastes in open air inside the compound(LIDI,2013).

4.3. Chemical usage and safety

When asked about their knowledge of chemicals used in tannery production process dissolved in water, 53% of the respondents disagreed that they know the chemicals (Table 13). Similarly about 69% of theme disagreed that they could tell about the most toxic chemical used in the tannery (Table 13). These data indicate that there are significant employees who have no specific knowledge about the chemical that they are using it but they are working on it simply by experience.

The tannery has tried to store chemicals in a good manner and it has separate chemical store, this is confirmed during the field visit .On the other hand, when employees were asked about whether they take training about safety and environmental protection training, 51% of them conform they have taken training in one form or another. However, still a considerable number of workers, i.e. 49% do not take such kind of training (Table 14).

Regarding the process of tanning taking much of water and chemical, 61% of the respondents replied the beam housing step uses a lot of water (Table 15). This implies ,to decrease the discharge waste of HAFPLC primarily technology transfer should be done on its beam house section.

Standardization and checking for the accuracy of weighing materials is very important inside the tannery because the amount of chemical affects the quality of leather and also helps in decreasing unnecessary chemical discharges during the tanning process. However, 53% of the respondents replied this practice is not at all performed in HAFPLC (Table 16). This indicates the uncertainty in the production process and consequence of unnecessary discharge of chemicals. It also increases the cost of production and also affects the quality of finished leather. Similarly, when respondents were asked about the sufficiency of chemical recipe monitoring, 47% of them disagree and 12% strongly disagree it is adequate (Table 17). This shows the unreliability of the chemical supervision system installment in the tannery according to the respondents.

Regarding the risk of chemical contamination to workers, 59% of the respondents replied that there is less risk, 27% answers sometimes there is risk, while 14 %said there is always risk (Table 18). This shows still considerable amount of workers believe they are subjected to risk during chemical handling. Similarly, asked about the effort of HAFPLC to assure workers health and condition, 11% of the respondents replied that the management is making strong effort, 58% responded that it is making some effort, while 31% replied that it is not making any effort (Table 19). This shows still there are significant amount of workers who are not convinced activities of the management in dealing with safety and health condition of the workers is enough.

The design and layout of a tannery contributes to the proper discharge of its waste. Related to this factor when the respondents were asked about whether the tannery structure well installed to let efficient wastewater out flow under the floor, 52% of them agreed, while 48% of them disagreed that it has this appropriate arrangement (Table 20). This implies that, there are significant workers who are not feeling comfortable by the layout of the tannery.

4.4. Impact on the environment

During the field visit it was observed that animals drink Sebeta river which carries discharge of factories alongside to the river. One of the farmers during FGD said the following: “I lost one cow during 2013 .It drank this river and passed away”. Other participants of the FGD also share this problem and added that, had it not been the situation improving we could have lost many animals.

This shows the severity of the problem and also supported by other similar studies. Most of the high water consuming industries in the Awash basin area draw water for production purposes from water supply sources and discharge their by-product wastes in to streams and rivers without any kind of treatment. Besides this, there is no restriction on industrial plants discharging their wastewater into the rivers and watercourses. The former EPA and ECPC realized that the tanneries built along the Awash river basin especially on the Akaki and little Akaki rivers carrying all the devastating pollutant wastes on their way to the neighboring peripheral Oromiya region need due attention (ECPC, 2004). Investigation made on the presence and concentration of heavy metals including toxic hexavalent Chromium from tanneries, in vegetable leafs irrigated by the Akaki River was found to be more than the maximum limit that may induce gastrointestinal ulceration and cancer (Prabu et.al, 2009).

Picture 3:- Animals drinking “unsafe” Sebeta river



Source: own photography during field survey.

During the FGD with the community leaders, they were determined to tell the effects on their livelihood. Asked about why not using sebeta river to irrigate visited plot of farming land in Roge village, one of the participants of the FGD said that, “we can use the polluted water but it will affect our health, i.e. resulted in itching of our leg and feeling of discomfort on our health.” In addition, the consequence for buyers will be damaging and it will harm their health. We will farm it when the rain is coming at least it decreases its pollution effect”. This is remarkable because of the fact that how much farmers are becoming more sensitive to industrial pollution

issues. The bottom line is, though Roge village community acknowledges there is improvement on discharge of HAFPLC and other nearby factories, still there are some farmers who are not confident to use the river for irrigation. This shows the need of sustainable solution for the environmental pollution problem in the Village which can bring confidence between the community and HAFPLC and other nearby factories.

Picture 4:-Effect on irrigation



Source: researchers own photographing during the survey

4.5. Environmental policy Analysis matrix.

The following table summarizes the response obtained from key respondents, FDG, and questionnaires survey about the implementation of environmental policies related to the case study.

Table 23:- Environmental policy implementation analysis.

No.	pertinent points in relation to this study	Implementation
1.	The Key Guiding Principles	
1.1	Every person has the right to live in a healthy environment;	This principle is not adequately implemented in Roge village. According to the FGD made with the local communities, there have been multiple impacts from the discharge by factories including HAFPLC, health problem on human and animals, Impact on farming and general eco-environment.
1.2	Sustainable environmental conditions and economic production systems are impossible in the absence of peace and personal security. This shall be assured through the acquisition of power by communities to make their own decisions on matters that affect their life and environment;	There is some effort to participate the local community by kebele 07 administration, however according to the participant of FDG; the issue is beyond the capacity of the kebele administration let alone by the community. ORLEMB forced by the local community in 2013 to address serious pollution caused by HAFPLC and shut down HAFPLC for one month. However to make this kind of decision issue is difficult and complex. The key respondent from ORLEMB also shares this idea, the decision making process is very difficult because there are several factors that should be considered.

No.	pertinent points in relation to this study	Implementation
1.3	The use of resources shall be minimized and where possible their availability extended (e.g. through recycling);	From Figure 4 we can see that, 83% of HAFPLC respondent believe there will no problem of depletion of water in the future, in addition ,the cost of recycling water by single tannery is very expensive according from the interview made with the key respondents from LDI, ELIA, and HFPLAC, this indicates this principle is difficult to apply because it is not feasible to HAFPLC.
1.4	Appropriate and affordable technologies which use renewable and non-renewable resources efficiently shall be adopted, adapted, developed and disseminated;	However 48% of the respondents believe that, there is problem in finance and technology in using ETP(Table 21); this shows the challenge to implement this principle.
1.5	Full environmental and social costs (or benefits foregone or lost) that may result through damage to resources or the environment as a result of degradation or pollution shall be incorporated into public and private sector planning and accounting, and decisions shall be based on minimizing and covering these costs;	HAFPC is established in 1995 before the implementation of EIA policy in 2002, hence the tannery is not checked for making EIA adequately
1.6	Market failures with regard to the pricing of natural, human-made and cultural resources, and failures in regulatory measures shall be corrected through the assessment and establishment of user fees, taxes, tax reductions or incentives;	According to the key respondent from LIDI, tanneries are exempted from tax when they import machineries for ETP.However still more assistance for tanneries is required on the form of reduction on tax profit to make them more competitive in the international market. LIDI with the help of UNIDO is undergoing feasibility study to establish CETP in Mojo city according the key respondent from LID and ELIA. It indicates the government is making some effort to address market in efficiency in

No.	pertinent points in relation to this study	Implementation
		relation to protection of the environment, however more incentives and there is high urgency in making the feasibility study practical.
1.7	Regular and accurate assessment and monitoring of environmental conditions shall be undertaken and the information widely disseminated within the population;	According to the key respondent from ORLEMB samples are tested one time in year and whenever necessary samples taken any time. However during the FGD it is observed there is lack of mistrust on the side of Roge villagers especially on the capacity and transparency of STEO on Data collection and dissemination process.
1.8	Increased awareness and understanding of environmental and resource issues shall be promoted by policy makers, by government officials and by the population, and the adoption of a "conservation culture" in environmental matters among all levels of society shall be encouraged;	There is some effort on awareness and understanding of the environmental issue. One participant farmer of the FGD said “yes I have participated in different conferences in different places, however we need action”. This shows lack of adequate and concrete project to solver environment pollution problem.
1.9	Natural resource and environmental management activities shall be integrated laterally across all sectors and vertically among all levels of organization;	CRGES designed to mainstream environmental protection issues by the government is good start according to the key respondent form MoI, however according to the key respondent from MoI , ORLEMB,STEO mentioned the problem of in adequate human and logistical resource problem for the implementation.
1.10	The integrated implementation of cross-sect oral and sect oral federal, regional and local policies and strategies shall be seen as a prerequisite to achieving the objectives of this Policy on the Environment.	According the key respondent form MoEF there is an effort to coordinate regions and sectoral institutions, however there is limitation due to capacity problem at National and regional levels.
2.	Control of Hazardous Materials and Pollution From Industrial Waste policies	

No.	pertinent points in relation to this study	Implementation
2.1	To adhere to the precautionary principle of minimizing and where possible preventing discharges of substances, biological materials or their fragments from industrial plants and personal or communal appliances or any other external sources that could be harmful, and to disallow the discharge when they are likely to be hazardous;	During the field visit HFPLC it observed that the tannery properly place chemicals and it has there is specific store for chemical, it also uses primary treatment plant and seen making some effort in treating the waste , however according to LIDI and ORELMB this is not enough. This show there is a gap in implementing this principle.
2.2	To adopt the "polluter pays" principle while endorsing the precautionary principle since pollution is likely to occur, and ensure that polluting enterprises and municipalities and wereda councils provide their own appropriate pollution control facilities;	Industrial proclamation NO.300/2002 ENVIRONMENTAL POLLUTION CONTROL PROCLAMATION puts this principle i.e. “natural person commits an offence if he discharges any pollutant contrary to the provisions of this Proclamation or regulations issued hereunder and is liable, on conviction, to a fine of not less than one thousand Birr and not more than five thousand Birr or to an imprisonment of not less than one year and not more than ten years or both and, in the case of a juridical person, to a fine of not less than five thousand Birr and not more than twenty five thousand Birr and an imprisonment of the officer in charge for a term of not less than five years and not more than ten years, or a fine of not less than five thousand Birr and not more than ten thousand Birr or both. “, how ever since authorities considers several factor specially effect on the economy most of the time use another approach, consultation and negotiation, this is also the case for HAFPLC according to ORLEMB.
2.3	To ensure that pollution control is proportionate with the influence, longevity and potential to increase or reproduce of the pollutant;	According to the FDG made with Roge villagers and the interview made with key respondents with ORLEMB it is difficult to implement this principle fully to HAFPLC, due to lack of Innovative instruments to implement environmental standards and guide lines to the leather industry.

No.	pertinent points in relation to this study	Implementation
2.4	To review and develop guidelines for waste disposal, public and industrial hygiene and techniques to enable the cost-effective implementation of defined standards of control, and to issue regulations to enforce them;	Environmental standards and guidelines for tanneries is established, however there is disagreement on the amount of chloride/salt discharged 1000mg/l, according LIDI and ELIA this standard is difficult to meet by tanneries it needs Advanced technology and expensive for individual tannery to recycle water
2.5	To maintain regular environmental audits to ensure the adoption of environmentally sound practices in all public and private development activities including industrial and mining operations;	According to the key informant form ORELMB, there is few audit in environment auditing practices due to human and resource capacity resource limitation.
2.6	To promote waste minimization processes, including the efficient recycling of materials wherever possible;	According to key respondent form HFAPLC and ELIA unless tanneries are clustered and related enterprise which use by product are established together recycling of waste from tanneries will not be feasible. This shows the importance of establishing Eco-Industrial parks to make recycling of wastes cost effective
2.7	To hold as legally liable an employer who deploys employees in using or handling hazardous materials without adequately training them on how to deal with the hazard and without adequate equipment to protect each one of them for physical harm or disease that is caused by working conditions whether the harm or disease starts in the place of work or away from it;	From the questioners survey in HAFPLC31% respondents believe HAFPLC's management is not making any effort about the safety of its workers, this shows still there are significant amount of workers who are not convinced activities of the management in dealing with safety and health condition of the workers is enough.
3	Community Participation and the Environment	
3.1	To ensure that all phases of environmental and resource development and management, from project conception to planning and	According to the FDG with community leaders, of Roge villagers are invited to participate on environment issues but they were not consulted

No.	pertinent points in relation to this study	Implementation
	implementation to monitoring and evaluation are undertaken based on the decisions of the resource users and managers;	when HAFPLC was established in 1995. This shows the limitation of information communication and consultation for a project.
4	Environmental Protection Organs Establishment	From interview of the key respondents from MoI, OELMB, STEO, limited resource is allocated for structures that follow environmental issues. There is also weak institutional capacity, STEO has no care and office has only 5 staff during the interview, However this office expected to follow more than 400 hundred industries in sebeta town. Similarly in MoI there is Industry zone and environment directorate however here also there is resource and human resource problem.

Source: researcher's own analysis based on Environmental policy of Ethiopia formulated in 1997.

4. 6.Challenges

The respondents from MoI and LIDI stress the less competitiveness of Ethiopian tanneries including HAFPLC; they are not motivated to incur this additional cost. They have problems in getting high quality and quantity of raw hides and skins, working capital constrains, absence of production and chemicals and components where as other countries such as India have this kind of advantage. The key respondent from ELIA also argued that Ethiopian tanning industry is less competitive, the industry has challenges like other manufacturing industries, ie. Industrial Input, finance, technology, logistic and customs, and power break. He added also the marketing problem to get the right buyers in the international market. Because of these factors it will be impractical to force individual tanneries to use more than primary and secondary ETP, to use tertiary ETP the cost will not be bearable, the tanneries will collapse financially.

There are also institutional capacity limitation and coordination problem between different stakeholders for supporting HAFPLC and other tanneries. The proclamation for the establishment of environmental protection organ advocates the establishment of organizational starting from federal to worda level. However during this research it was observed that, there are limited human and logistical resources, in addition, there is also capacity problems. For example it is observed that STEO which is expected to follow up more than 400 industries in Sebta city has only five staff and the office has no car for its operation. There are similar responses from the key respondents from MoI and LIDI. The MOI have Industry zone and Environment Directorate, LIDI have environment directorate separately. However, they have limitation of capacity, according to the key respondent from these institutions.

The MoEF is giving capacity building training and coordination of regional and federal institutional arrangements for the implementation of environmental standards and guide lines according to the key respondents from the ministry. In addition to this, it transfers its EIA mandates for selected federal government ministries including MoI to follow projects. Due to capacity and resource limitation the coordination between MoEF, MoI, and ORLEMB is not strong according to the key respondent from MoEF.

CHAPTER FIVE

5. SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS.

On previous chapter data interpretation and analysis is made, hence this chapter provides the summary of the major findings of the study; it draws conclusions and forwards recommendations by the researcher in relation to the basic research questions of the study.

5.1. Summary of findings

The objective of this study was to assess leather industry environmental challenges specifically taking HAFPLC as case study. After the data interpretation and analysis the following major findings were obtained.

- ❖ From this study it is found that different stakeholders have different conception about leather industry and environmental sustainability i.e, MoI, ELIA, and LIDI advocates a balanced approach between the growth of this industry environmental sustainability. On the other hand Roge villagers have more concerns on the impact of waste from HAFPLC and other industries in their vicinity.
- ❖ Most HAFPLC workers agree on the importance of application of environmental guidelines and standards by the tannery; however, it is found that they have wrong conception about water. Most of HFPLC workers think that water could not be a problem in the future and there is because their factory have cheap ground water source for the time being.
- ❖ There have been mainstreaming limitations of environmental protections issues in annual plans especially before the formulation of CRGE. The government of Ethiopia initiated CRGES; the direct application of this strategy to the tanning industry is not commenced

yet. The MOI and LIDI realized the consequence of environmental waste to leather industry and the idea of establishing CETP is a good start, also the starting of Industry Park development shows the government wants to address pollution problem; however it requires more urgency in implementing feasibility studies in to action.

- ❖ Environmental policy, regulations and standards are not properly implemented by HAFPLC due to lack of cost effective mechanism of treating its waste, financial constraint and skill in running CETP. Using ETP by HAFPLC has its additional cost of production , this cost coupled with the less competitiveness nature of the tannery in the internal market results in discharging waste water without treating adequately to the environment.
- ❖ There are considerable amount of workers who are not comfortable with the safety measures in HAFPLC. Though there are some attempts by the tannery such as preparing separate chemical wear hose, it is found that there are significant number of employees who do not take training about environment protection and safety.
- ❖ Though there is some improvement waste discharge by HAFPLC, it has been affecting the ``Roge’’ villages environment, it affects human and animal health. Some farmers have no confidence to use sebeta river for irrigation purpose and all in all it damages the overall ecology of the village. There is policy implementation gap in realization of environmental policy in Roge village.
- ❖ Though the community leaders of this village have the chance to participate in environmental issues; there have been capacity limitation and weak coordination between government institutions to bring innovative ways and solution for the waste discharged by HAFPLC and other companies near sebeta river. Lack of practical solution in keeping the environment sustainably is making theme investment phobic about future projects in their village; this is dangerous because of the fact that without future investments it is difficult to bring economic growth.
- ❖ There are some institutional establishments starting from to the federal MoEF , MoI, LIDI, to regional ,ORLEMB and worda level STEO .However , there is capacity

limitation and logistical problem according to the key respondents from this institutions. The coordination between different stakeholders in the implementation of Environmental standards to the leather industry is weak due to different priorities and focus of different stakeholders. For instance, the MoI gives more focus to the export targets, less mainstreaming of environmental issues especially before the formulation of CRGES; whereas environmental institutions MoEF, ORLEMB and STO have great concern on the environment issues but lack of bringing innovative solution.

5.2. Conclusions

After the Data interpretation and analysis form the previous chapter and the main findings from the following points are derived as the conclusions of this study.

- ❖ HAFPLC workers have good conception on the importance of protecting the environment; however, there is wrong conception about water by HAFPLC works and other stake holders thinking ground water as something which would not be depleted in the future. This is also resulted in not economical usage of water and allot of discharge by HAFPLC. The mind set of HAFPLC's management towards protecting the environment is based on afraid of penalty not willingly to protect the environment.
- ❖ Stake holders such as MoI and LIDI have the Understanding of environmental Issues however they are in delinquent situation regarding to the environmental sustainability with economic growth and foreign exchange earnings, there have been tilted approach to the economic benefit rather than environmental issues because of the strong desire to economic growth and the country desperately foreign exchange, after CRGES there is more streaming of environmental protection issues to industrialization process than before.

- ❖ HAFPLC is not sufficiently implementing the industrial pollutions guide lines and standards, it does not fully comply with discharge limits and other safety regulations. Although there is some improvement from the previous year's HAFPLC waste discharge have been affecting human and animal health, generally the downstream ecology of “Roge village” and the tannery have not doing its social responsibility adequately in keeping safe the surrounding environment.
- ❖ Even though there is more efforts now days by the government of Ethiopia to implement its environment policy, “The Key Guiding Principles” of the Ethiopian environmental policy such as “Every person has the right to live in a healthy environment, Control of Hazardous Materials and Pollution From Industrial Waste policies, Community Participation and the Environment, Environmental Protection Organs Establishment” have not been adequately implemented in “Roge village” ,i.e. There is environmental policy implementation gap in relation to the case study.
- ❖ The HAFPLC and most Ethiopian tanneries sell their products in lower price; they have less connection to the main buyers. In addition there are factors which make less competitive markets, importing inputs including chemical, high logistic costs, working capital problem, technological capability, power problem; all over they are less competitive like other manufacturing industry in Ethiopia. Hence they do not want to bear additional costs to environment. There is also technology limitation in running the tannery's ETP , the bottom line is HAFPLC is not in opposition to treat its waste disposal cost efficiently in sustainable manner unless otherwise there is government intervention and support . The community in this case bearing HAFPLC's in efficiency and the Unfair international trade practices.

5.2. Recommendations.

The following recommendations are made by the researchers for policy makers and other stake holders who are involved different activities relation to the research topic of this study.

- ❖ There are different constrains which makes Ethiopian tanneries less competitive in the international market. Hence, the government should apply more measures which help to

decrease their production and logistics costs, also support should be provided in marketing. This will incentivize to apply environmental standards and guide lines.

- ❖ The ORLEMB and SOE have to use participatory approaches in dealing with the environmental protection problem caused by HAFPLC and other factories around Roge villagers. For example they should get chance before the approval of new investment projects by ORLEMB.
- ❖ Combined concrete policy implementation mechanisms should be designed to solve environmental impact caused by HAFPLC and other tanneries which include innovative approach such as establishing EIPs, subsidies in the form of taxation, Eco -labeling, helping tanneries ISO certification.
- ❖ The development of EIPs is should be a strategy for green-Industrialization of the Ethiopia; this could be also translated to the establishment of Eco-leather Industry parks. Industrial parks which have complete infrastructure including CETP helps tanneries in decreasing cost of effluent treatment. The government should support HAFPLC and other tanneries by making practical immediately its plan for establishing leather industry complex in Mojo city which has CETP, This will allow in minimizing the waste treatment cost at the same minimizing environmental pollution. Hence the government should relocate specially the beam house section of HAFPLC and other tanneries to the park.
- ❖ The MoEF should give more training on the environmental protection and workers safety, and training on maintenance and over all use of ETP has to be given by LIDI on for those workers who are running ETP of HAFPLC.
- ❖ To implement environmental standards and policies to tanneries including HAFPLC, the supervision capacity of STEO, MoI and LID should be strengthened; sufficient budget should be allocated to it. All in all, institutional capacity building task and effective coordination mechanism should be given emphasis.

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Annex I Questionnaire, checklists, guiding interview questions for key informants and focused group discussions involving different stakeholders.

1. Questionnaire for Haffed tannery Respondents:-

Questionnaire:

The objective of this study is to find out the environmental challenge of the leather Industry towards to the environment, the case of HAFPLC and make possible recommendations for implementing environmental policy guide lines to leather Industry. This requires your genuine response for the research questions posed in any form. It is worthwhile to confirm that any information you give us is maintained confidential. Your contribution is highly appreciated.

Instruction: - Please mark „X“ of your preference/choice/ in the blank space where it exists.

General

a/production and quality managers

b/ Effluent treatment plant manager

c/ Tannery process shift leader

d/ Supervisors , operators, workers

1 Section/Department_____

2. Education back ground 1.less than Grade 10_____ 2.TVT /Diploma_____

3. BA/BSC Degree_____ 4 .MA and above_____

3 .Experience, 1.Less than 5 years____2. 5 to 10 Years____.3 and above ten year_____

4. Sex 1 .Female _____, 2.Male_____

I. Conception about environmental sustainability

1. What do you think is the main reason of installing ETP in the tannery?

1. To protect the environment____ 2.To secure tannery penalty____ 3.I don't understand_____

2. Do you exactly know the source of water the tannery uses for production process?

Rain water____ 2.Ground water____ 3.Municipal water____ 4.Iam not sure____

3. Have you ever thought of water scarcity sometime in the future used for industrial (tannery) production? 1. Agrees____ 2. Disagrees_____

4. Do you feel comfortable with the odor from the tannery? 1. Not comfortable__ 2.Stongly not comfortable .3.Not affecting them__

If No, did you ever projected to other community and strive to solve the problem?

1. yes____ 2. NO____

If yes, comment-----

II. Implementation of Environmental standards and regulations.

1 .Is HFPLAC applies Environmental guide lines to the leather Industry?

1. Strongly agrees-----2.Agree-----3. Disagree-s---3.strongly disagrees4. I don't have any Idea-----

2. What kind of treatment plant your tannery Installed

1. Primary-----2 Secondary..... 3) Tertiary.....4) Have no any treatment plant

If you have Treatment plant, Is it working properly 1.Yeas____2.No____3.I do not know_____

3. How is the wastewater discharged in the tannery you are working? 1. Directly to the soil____ 2.directly to the river nearby____ 3.to the river through the treatment plant____

4. Is there any sludge disposal site you know post tannery processing? 1. Agrees__ 2. Disagrees__
- If yes, is that site free of another environmental threat? 1. Agrees__ 2. Disagrees__
5. Is there any scheduled awareness creation program on waste water management issues in the tannery? 1. Yes__ 2. No__
6. Do you know kinds of chemicals used in tannery production processes dissolved in water?
1. Yes_ 2. No__
2. Can you tell the most toxic chemical composing the wastewater in the tannery?
1. Yes__ 2. No__
7. What tannery production stage you think requires modifications to minimize wastewater generation?_____
8. Where are the tannery chemical stored?
1. in separate store away from the tannery____. 2. in the processing area in the tannery__ 3. There is no defined organized chemical store I know._____
9. Is the tannery chemical weighing materials checked and standardized for accuracy?
1. Frequently____ 2. Sometimes____ 3. Not at all____
10. Do you think appropriate on job training given to the tannery chemical weighers concerning safety and recipe optimization?
1. Agrees__ 2. Disagrees____
11. How is about the adequacy of chemical recipe monitoring system installment in the tannery?
1. Efficient____ 2. satisfactory____ 3. inadequate____
12. Is the water used for tannery processing pre-treated? 1. Agrees__ 2. Disagrees____
13. If No, what affect it has on machinery performance and efficiency?
14. Is water left running between production stages? 1. Yes____ 2. No____
15. Is fresh water used in every new bath? 1. Yes____ 2. No____
- 16.. Have you ever seen water reuse and recycling in any tannery production processes?
1. Yes____ 2. No____
17. Are hides pre-cleaned before they are washed? 1. Yes__ 2. No____
18. Which production processes are most prone to mistakes and wasted products in water utilization?_____

19. Which production processes are easier to modify with respect to wastewater generation?
20. Is there any safety measure in place and significant commitment from the management to improve health condition? 1. Yes___ 2.No___
21. How often are workers exposed to chemicals dissolved in water?
 .Frequently___ 2.Sometimes_____ 3.Not at all___
22. Is the tannery structure well installed to let efficient wastewater outflow under the floor?
 1. Yes_____ 2.No_____ 3. I don't have an idea

Can you imagine the contamination level of the river passing by the tannery you are working?_____

If you think it is polluted, whatever the level, what is your personal effort to protect the environment_____

II. Challenges

What is/ are the main challenge/s in using waste treatment plant by your tannery?

1. Finance_____ 2.knowledge to use the treatment plant3) both 1 and 2
4. other than these_____
2. Pleas mention any other challenge_____

III. Future Recommendations

Please make possible recommendations to implement cost effective mechanism in using effective treatment plants by Haffed Tannery and other tanneries?

2. Research stakeholders: - key informant interview questionnaire guide.

The objective of this study is to find out the environmental challenge of the leather Industry towards to the environment, the case of HAFPLC and make possible recommendations for Implementing environmental policy guide lines to leather Industry. This requires your genuine response for the research questions posed in any form. It is worthwhile to confirm that any information you give us is maintained confidential. Your contribution is highly appreciated.

A. Ministry of Industry/MOI/-Industry Zones and Environment Directorate.

- ✓ What are the key issues with respect to industrial /environmental/ policy executions and implementation status?
- ✓ Understanding related to quality industrial/ tannery/products and services in relation to global market requirements and standards.
- ✓ Compliance with current global perception on pollution prevention and effective natural resource management.
- ✓ How is the implementation of the program on the best available technology/BAT/ transfer and retention accomplishments in Ethiopia tanneries?
- ✓ Is there organized and structured effluent/wastewater /management system installed to assure efficiency and production process integration in tanneries?
- ✓ How are the sectorial and institutional government's bodies integrated to execute policies, regulations and legislations?
- ✓ Is there any wastewater treatment plant performance monitoring and empowerment system in cooperation with non- governmental development organizations?
- ✓ Commitments towards EIA and Environmental Audit issues.
- ✓ Justification why industries/tanneries/ are let to establish plants along river courses.
- ✓ Capacity building in relation to tannery wastewater management accomplished so far if any.
- ✓ Future plan of Ministry of Industry (MoI) for Minimizing Environmental pollution by Tanneries.

B. Leather Industry Development Institute/LIDI/- Environment protection Directorate

- ✓ Role of the Institute for Environment protection.
- ✓ What is your perception on sustainable development issues in relation to waste management in general and wastewater management in particular?
- ✓ The Emphasis of LIDI in implementing environmental policy to leather Industry
- ✓ The current statute of Ethiopian tanneries in using effective treatment plant, and Haffed Tannery specifically.
- ✓ Challenges and opportunities of working with private tanneries and sectorial government bodies with respect to environmental protection, mitigation options and Baste Available Technology (BAT) Transfer institutional performances.
- ✓ Recommend best possible mechanisms and Incentive schemes for Tanneries in using effective waste treatment plants

C. Ministry of Environment and forest –Legal Enforcement section

- ✓ What is your perception on sustainable development issues in relation to waste management in general and wastewater management in particular?
- ✓ Basic role that your ministry plays with respect to pollution control in industries/tanneries/.
- ✓ How do you evaluate implementations compliance and enforcements of environmental policies, regulations and legislations?
- ✓ The current statute of Ethiopian tanneries in using effective treatment plant, and Haffed Tannery specifically.
- ✓ How is tannery wastewater management problems addressed in your section?
- ✓ How your ministry is integrated with Ministry of Industry (MoI), Leather Industry Development Institute, Oromia environmental protection bureau and Tanneries to prevent river pollution to assure community welfare?
- ✓ Facilitation schemes as to awareness creation on how to effectively manage wastewater in tanneries if any.

D. Sebta town environment protection office and Oromia regional state Land and Environment Management Bureau.

- ✓ How your Bureau follows up the implementation of the Environmental policy guide line to leather Industry
- ✓ The status of Haffed Tannery in polluting The downstream river and the environment in general
- ✓ The response of federal and regional ,and Haffed Tannery in implementing Environmental policy regulations
- ✓ What Do you Think Tanneries are less reactive to Implement Environmental policy regulations
- ✓ The main challenges implementing Environmental policy guide line to leather Industry
- ✓ Future recommendations for minimizing the environmental challenge by Haffed Tannery

E. Ethiopia Leather Industries Association-Person in charge

Checklist for Interview

- ✓ What is your perception on sustainable development issues in relation to waste management in general and wastewater management in particular?
- ✓ Role of the association to safeguard the community welfare
- ✓ How do you evaluate the current Implementation of Environmental policy guide line to leather Industry?
- ✓ Do reluctance of private tannery owners to mitigate environmental adverse impacts recognized as a problem by the association?
- ✓ What are the main challenges to use Treatment plant by Tanneries
- ✓ Propose and cost effective mechanism of Tannery waste Disposal which could be used in the future.

**F. Focused Group Discussion (FDG) with “Roge” villagers /In sebta town/ Administration/-
Dow stream villagers of HAFPLC**

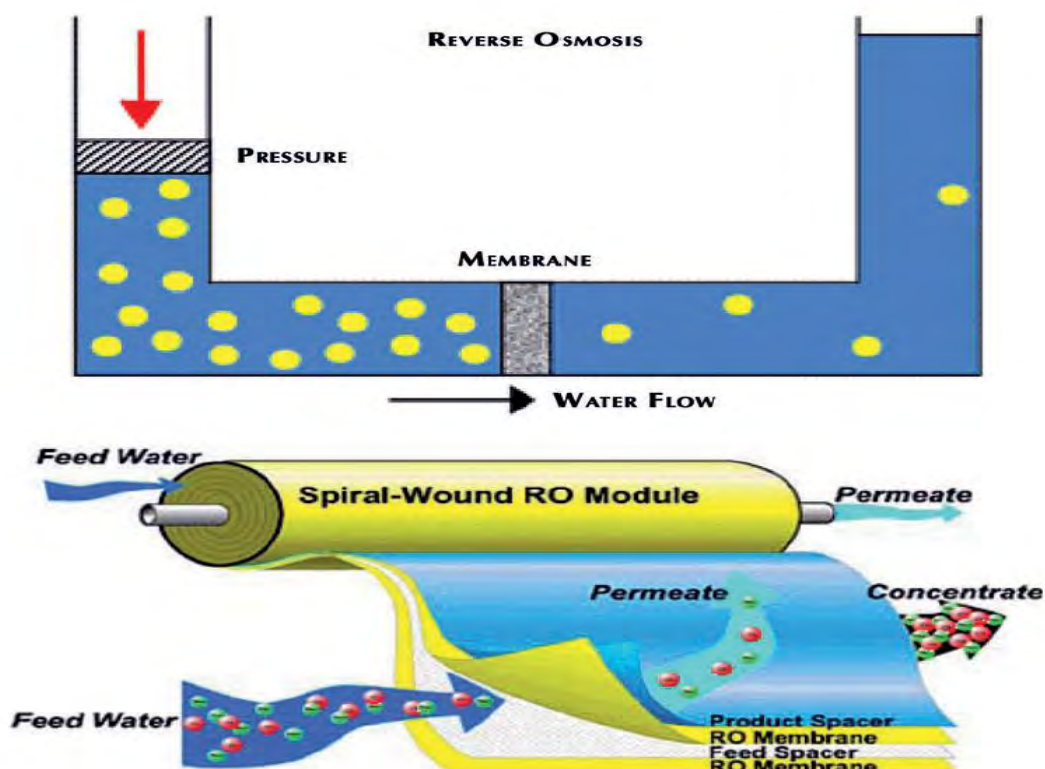
- ✓ How Haffed Tannery affects your Environment?
- ✓ Did you participate in discussions conducted with other parties concerning environmental pollution/river pollution/?
- ✓ What is your understanding about the right of living in a clean environment?
- ✓ As a community did you face unresolved challenges related to the wastewater?
- ✓ What do you think is your own role other than different parties in creating quality life?
- ✓ Your perception about tannery?
- ✓ How do you describe tannery in terms of environment and development?
- ✓ Thank you.

Annex II projects subject to environmental impact assessment

	Project Types Subject to Environmental Impact Assessment
1.	Mine Exploration that is subject to Federal Government Permit
2.	Dam and Reservoir Construction • Dam height 15 meter or more, or • Reservoir storage capacity 3 million m³ or more, or • Power generation capacity 10 MW or more.
3.	Irrigation Development • Irrigated area of 3000 ha or more
4.	• Construction of Roads (Design Standard DS1, DS2 and DS3) with a traffic flow of 1000 or more • Railway Construction
5.	Taking Fish from Lakes on a commercial Scale
6.	Horticulture and Floriculture Development for export
7.	Textile Factory
8.	Tannery
9.	Sugar Refinery
10.	Cement Factory
11.	Tyre Factory with Production Capacity of 15 000 Kg/day or more
12.	Construction of urban and industrial waste disposal facility
13.	Paper Factory
14.	Abattoir Construction with Slaughtering Capacity of 10 000/Year or more
15.	Hospital Construction
16.	Basic Chemicals and Chemical Products Manufacturing Factory
17.	Any project planned to be implemented in or near areas designated as protected.
18.	Metallurgical Factory with a Daily Production Capacity of Equal or More Than 24 000 Kilogram.
19.	Airport Construction
20.	Installation for the Storage of Petroleum Products with a Capacity of 25,000 Liters or more.
21.	Establishment of Industrial Zone
22.	Condominium construction

Source, directive no.1/ 2008 a directive issued to determine projects subject to environmental impact assessment, EPA

Annex III photos cross sections of a circular sedimentation tank



Source: UNIDO (2011:p.54)