Indian Leather Sector Network Report

Network Overview

Within the initiative

Sustainable Industrial Networks and Its applications on Micro Regional Environmental Planning (SINET)

Partner Organizations

Project Team

International Council of Swedish Industry (NIR), Sweden	Mr. Andreas von der Heide, CEO,
	Mr. Shisher Kumra, Director EU Coordination
	Ms. Josephine Gustafson
	Ms. Mimmi Bergstorm
Network for Preventive Environmental Management (NetPEM) Public Trust, India	Mr. N. R. Kirshnan, Senior Advisor
	Dr. Rashmi Naidu, Programme Coordinator
	Mr. Shrirang Bhoot, Asst. Coordinator
	Mr. Anand Deshmukh, Junior Researcher
	Ms. Mrinmayi Chavan, Junior Researcher
	Ms. Sonia Pawaar, Administrative Secretary
Flemish Institute for Technological Research (ViTO), Belgium	Mr. Walther Van Aerschot, Project Leader
Confederation of Indian Industry (CII), India	Mr. K. P. Nyati, Principal Advisor
	Dr. Aditi Haldar, Councellor
	Ms. Arvinder Kaur, Deputy Director
	Mr. Deepak Juneja, Event Manager

Asia Pro Eco Programme

Is a five years programme launched by European Union in 2002, The main target is to adopt policies, technologies, and practices that promote cleaner, more resource efficient, sustainable solutions to environmental problems in Asia. The programme provides support through grants to policy reinforcement, operational and practical dialogue, diagnostic studies, technology partnership and demonstration projects, in the field of environment. The programme supports non profit organizations from EU and Asia.

About SINET

The aim of sustainable industrial network and its application on micro regional environmental planning is to interpret and adapt an understanding of the natural system and apply it to the design of the man-made system, in order to achieve a pattern of industrialization that is not only more efficient, but which is intrinsically adjusted to the tolerances and characteristics of the natural system. An industrial system of this type will have built-in insurance against environmental surprises, because their underlying causes will have been eliminated at the design stage. A micro-region is a distinct territorial unit with clearly marked boundaries below the regional level, but above the village level. Micro-regional environmental planning attempts to coordinate the planning activities of the various actors within a limited territorial unit.

The project will look at analyzing and documenting various success and failure stories of industry networks from Sweden/Europe and India/Asia, and to ascertain their impacts on environment and sustainability aspects of the respective micro regions. Emphasis will also be placed on creating awareness on the influence of industry network (key economic activity) on the micro region's environmental and sustainability aspects.

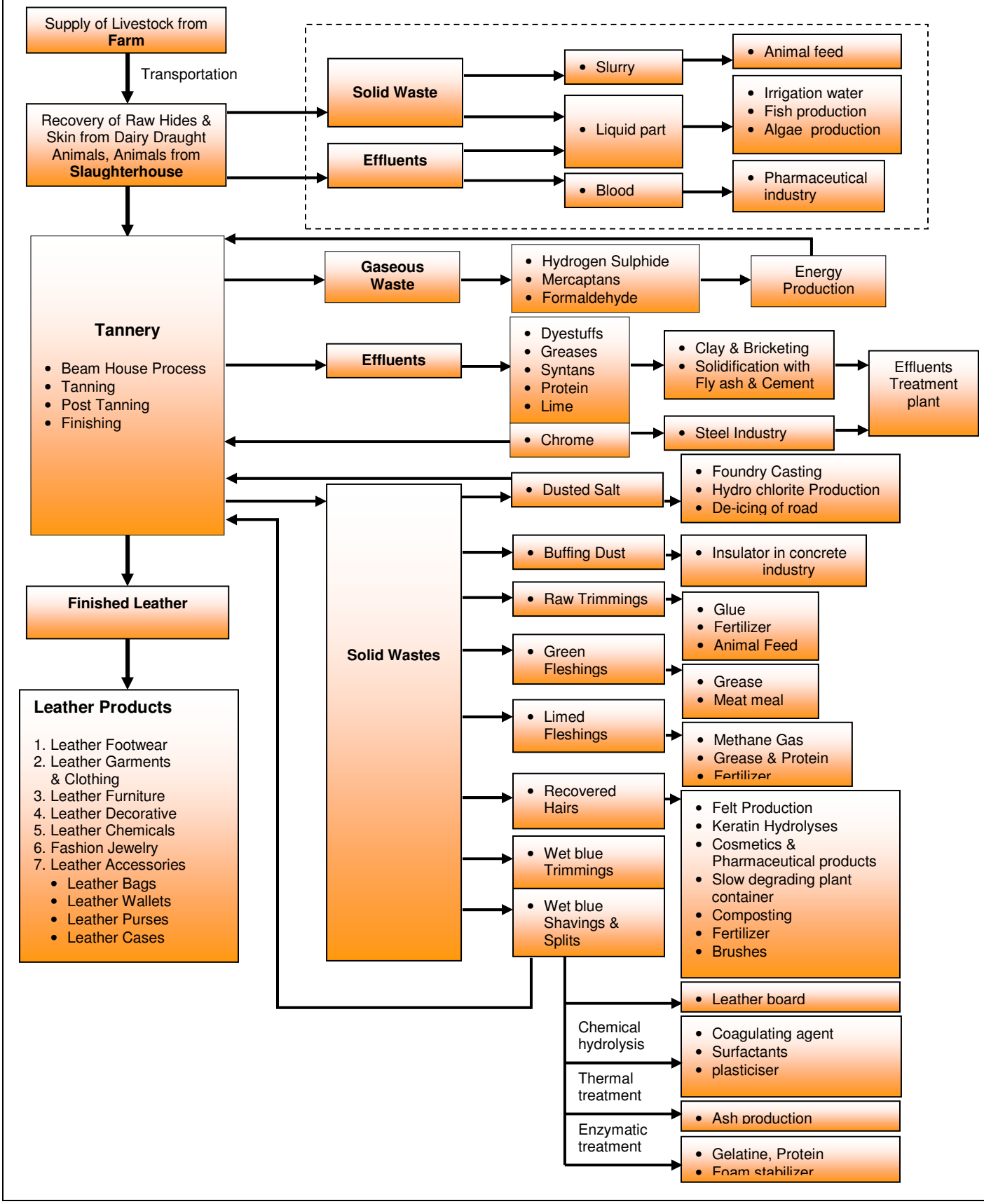
Contact Us

SINET Conference Secretariat - India
(NetPEM) Public Trust,
301, 3rd Floor, Samved Sankul, Temple Road, Civil Lines,
Nagpur – 440001, India.
Phone: +91- 712 – 2552725/26,
Telefax: +91- 712 – 2562723
Email: coordinator@sinetinfo.org

SINET Conference Secretariat - Europe
Ms. Josephine Gustafson,
International Council of Swedish Industry (NIR)
P.O. Box 5501, S-114 85 Stockholm
SWEDEN
Phone: +46 8 783 80 00 Fax**:** +46 8 665 90 29
Email:josephine@nir.se

TABLE OF CONTENT

Leather Industry Network



Sector Network

An ideal leather industry network comprised of the following:

- Livestock (Cattle, Buffalo, Goat)
- Slaughter houses
- Raw Hide/Skin Collection
- Tanning Industry
- Leather Industry
- Export Market
- Other Allied Industries

The other small industries that can co-exist within this network are the glue and manure manufacturing industries that utilize the bones and discarded organs of the slaughtered animals respectively. Besides, operating in close co-operation with the slaughter houses are corporations that have built their services and products around the meat-consuming market - processors of meat into various forms of fast food, processed meat transporters, deep freezer manufacturers, cattle feed 'enhancers', drug manufacturers who sell 'meat growth hormones' and antibiotics for cattle and even agribusiness' banks that will give loans only for cattle 'producing'. Not to forget the fast-growing biotech industry.

Other value added product manufacturing industries like Meat-cum-Bone Meal (MBM), Tallow, Bone Chips, Pet Foods and Methane as a source of energy can also exists close to the slaughter houses.

Livestock base

The leather industry in India owes its origin and growth to the strong and wide spread livestock base in the country. India is the leading livestock holding country in the world. It ranks first in the case of cattle (including buffaloes), second in goats and fourth in the case of sheep. India has a predominar share of buffaloes. While buffaloes and goats have recorded annual growth rates of 1.86% and 3.11% respectively, cattle and sheep have recorded a marginal growth of rate of 0.52%. These animals send by truck or rail from a ranch, farm, or feedlot to the slaughterhouse. These are herded into holding pens, which receive a preslaughter inspection.

Slaughter Houses

In developing countries a large variety of slaughter sites exists. Slaughter sites vary from simple slaughter slabs to very modern slaughterhouses. Large scale industrial processing units are imported from developed countries, often without rendering or waste treatment facilities. Many slaughterhouses (of various types) are unsanitary and pose threats to health, particularly around rapidly expanding population areas. Often old slaughterhouses discharge blood and untreated wastewater. The elimination of sick animals and subsequent destruction are frequently carried out inappropriately (Kaasschieter, 1991a). Blood may coagulate in drains where it putrefies, causing bad odour and sanitary and environmental problems. Edible and inedible by-products are frequently wasted during the slaughtering.

Charges for slaughtering in abattoirs are often kept low to prevent illegal slaughtering. Furthermore, slaughter fees constitute a source of income for the municipality. As however these funds are not used for the operation and maintenance of the abattoir, abattoirs have difficulties in maintaining certain standards.

Approximately 80 percent of the population in developing countries lives in rural areas (Kumar, 1989). The great majority of animals are likely to be slaughtered and processed domestically or in small slaughter slabs. The processing and the utilization of offal require a technology and capital lay-out which are completely different from those in developed countries. Huge capital investments in infrastructure of plants and machinery, as is the case in developed countries cannot be justified. In developing countries also most of the soft and fat tissues are used for consumption purposes. This reduces the amount of offal with 10-15% of the live weight killed (LWK).

The incidence of natural death of livestock in developing countries is relatively high. This rather leads to sanitary problems than to environmental problems as most of the dead animals are scattered over large areas.

In the slaughter process basically the following by-products and waste products become available:

- manure, contents of rumen and intestines
- edible products such as blood and liver;
- inedible products such as hair, bones, feathers;
- fat (recovered from the wastewater by means of fat-separators); and
- wastewater.

- **Availability of hides and skins**

Hides (from cattle and buffaloes) and skins (from goats and sheep) the basic raw materials for leather industry are obtained from slaughtered and dead ovine and bovine animals. The quality of hides and skins depends upon the area from which they originate. India is known to produce some superior qualities of hides and skins. The goat skins of North Bihar and Bengal (The Ganges valley) possess very fine grain and are prized all over the world as the finest raw material for superior glazed kid leather. The current annual availability of hides and skins is placed around 160 million pieces. It is estimated that 40 to 50 percent of cattle hides and 30 to 40 percent of buffalo' hides are obtained from fallen stock. In case of cattle hides, only 79 percent of the fallen stock is recovered. In buffaloes hides and sheep skins the recovery is around 90 percent. If the rate of recovery is improved there will be substantial increase in the overall availability of hides and skins.

- **Industry concentrated in a few states**

Even though hides and skins are available all over the plains of the country, tanneries came to be established in Calcutta and Madras regions predominantly because export trading in hides and skins were taking place from these port towns which had a strong linkage to the British traders. These centres still dominate the scene.

Raw Hide/Skin Collection

The age-old system of collection, transportation and marketing continues to exist with minor changes. The establishment of common slaughter houses in municipalities and corporations is an improvement over the system. The general pattern of production, collection and marketing of hides and skins in India is in the following order:

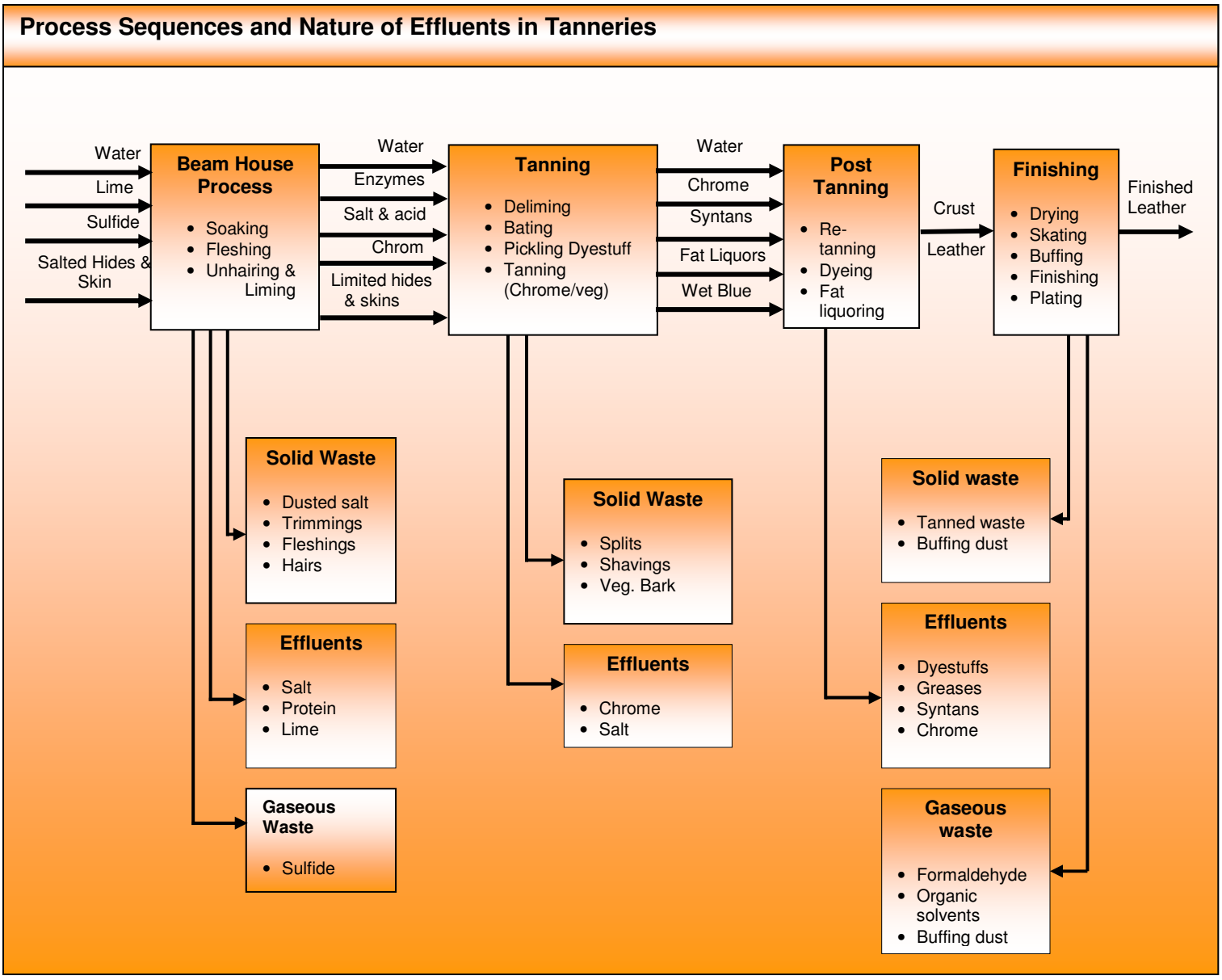
- Primary producers in villages and urban areas
- Local shandis
- Local merchants who buy from shandis and slaughter houses
- Commission mundis/agents

There are more than 25 markets across the length and breadth of the country. The Commission Agents dominate these markets. The major markets are Chennai, Delhi, Bombay, Kanpur, Jallandhar and Calcutta. The tanneries in Ambur buy raw hides and skins from Commission Agents all over the country.

Tanning Industry

Hides and skins are then processed into a wide range of end products. For each end product, the tanning process is different and the kind and amount of waste produced may vary enormously.
No industrial license is required for processing of hides and skins from wet blue stage to finished leather. However, the location of industrial projects will be subject to Central or State

Environmental laws or regulation, zoning and land use regulation. An industrial Entrepreneur Memorandum needs to be filed with the Central Government.



Leather Tanning & Finishing

The chemicals traditionally used for tanning have been derived from plants, whereas the most common process nowadays is a combination of chrome salts (chrome tanning) and readily usable vegetable extracts (vegetable tanning). While chrome tanned shoe leather is the most widely produced leather, this kind of leather will receive most attention in the following.

In most cases raw hides produced at slaughterhouses are preserved by pickling and drying for transport to tanneries and further treatment. In the very few cases that hides are instantly tanned, there is no need for preservation. During the tanning process at least ±300 kg chemicals (lime, salt etc.) is added per ton of hides.

- **Pretanning (Beamhouse operations)**

Soaking:

The preserved raw hides regain their normal water contents. Dirt, manure, blood, preservatives (sodium chloride, bactericides) etc. are removed.

Fleshing and trimming:

Extraneous tissue is removed. Unhairing is done by chemical dissolution of the hair and epidermis with an alkaline medium of sulphide and lime. When after skinning at the slaughterhouse, the hide appears to contain excessive meat, fleshing usually precedes unhairing and liming.

Bating:

The unhaired, fleshed and alkaline hides are neutralized (deliming) with acid ammonium salts and treated with enzymes, similar to those found in the digestive system, to remove hair remnants and to degrade proteins. During this process hair roots and pigments are removed. The hides become somewhat softer by this enzyme treatment.

Pickling:

Pickling increases the acidity of the hide to a pH of 3, enabling chromium tannins to enter the hide. Salts are added to prevent the hide from swelling. For preservation purposes, 0.03 - 2 weight percent of fungicides and bactericides are applied.

- **Tanning**

There are two possible processes:

1. Chrome tanning

After pickling, when the pH is low, chromium salts (Cr^{3+}) are added. To fixate the chromium, the pH is slowly increased through addition of a base. The process of chromium tanning is based on the cross-linkage of chromium ions with free carboxyl groups in the collagen. It makes the hide resistant to bacteria and high temperature. The chromium-tanned hide contains about 2-3 dry weight percent of Cr^{3+}. Wetblue, i.e. the raw hide after the chrome-tanning process, has about 40 percent of dry matter.

2. Vegetable tanning

Vegetable tanning is usually accomplished in a series of vats (first the rocker-section vats in which the liquor is agitated and second the lay-away vats without agitation) with increasing concentrations of tanning liquor. Vegetable tannins are polyphenolic compounds of two types: hydrolysable tannins (i.e. chestnut and myrobalan) which are derivatives of pyrogallols and condensed tannins (i.e. hemlock and wattle) which are derivatives from catechol. Vegetable tanning probably results from hydrogen bonding of the tanning phenolic groups to the peptide bonds of the protein chains. In some cases as much as 50% by weight of tannin is incorporated into the hide (Ockermann and Hansen, 1988).

- **Finishing**

Wet blue:

Chromium tanned hides are often retanned during which process the desirable properties of more than one tanning agent are combined and treated with dye and fat to obtain the proper filling, smoothness and colour. Before actual drying is allowed to take place, the surplus water is removed to make the hides suitable for splitting and shaving. Splitting and shaving is done to obtain the desired thickness of the hide. The most common way of drying is vacuum drying. Cooling water used in this process is usually circulated and is not contaminated.

Crust:

The crust that results after retanning and drying is subjected to a number of finishing operations. The purpose of these operations is to make the hide softer and to mask small mistakes. The hide is treated with an organic solvent or water based dye and varnish. The finished end product has between 66 and 85 weight percent of dry matter.

- **Effluents**

In most developing countries, tannery effluents are discharged into sewers or inland surface waters and/or brought onto the land with irrigation water. The high concentration of salt and hydrogen sulphide in tannery wastewater affects the quality of water and may cause bad taste and odour. Suspended matter (lime, hair, fleshing, etc.) makes the surface water turbid and settles eventually on the bottom. Both processes create unfavorable conditions for aquatic life. Mineral tannery wastewater that is discharged on land will affect the soil productivity adversely and may cause land to become infertile. As a result of infiltration, the quality of the ground water is affected adversely also. Discharge of untreated tannery effluents into the sewer system causes deposition of calcium carbonate and choking of the sewer.

In developed countries the tannery effluent is treated intensively before it is discharged into surface water. As a result of wastewater purification the chromium and BOD levels of the purified water is relatively low. The sludge in the waste water systems has to be brought to special dumping grounds because of its chromium content.

The sensitivity to chromium of different species of aquatic organisms varies greatly. Hexavalent chromium is a strong oxidizing agent, and therefore more toxic than trivalent chromium. Chromium deactivates cellular proteins. Lethal levels for fish range from 17 to 118 mg/l, 0.05 mg/l for invertebrates, and 0.032 to 6.4 mg/l for algae (Anonymous, 1974). The concentration apparently safe for fish is moderately high, but a recommended maximum concentration of 0.05 mg/l (WHO standard for drinking water) has been selected in order to protect other organisms, in particular Daphnia and certain diatoms which are affected at levels slightly below this concentration.

Inside the tannery, chromium should be handled with care, since exposure to elevated concentrations of chromium in the air (> 0.1 mg/m3) may lead to lung cancer (Anonymous, 1974).

- **Dominance of SSI Units in Tanning Sector**

SSI Units dominate the tanning sector as well as products sectors. This is due to the conscious policy of the government to protect the millions of artisans dependent on leather industry for their livelihood. Hence almost all items of leather industry were reserved for small scale sector.

The products reserved for small-scale sectors are:

- Vegetable tanned hides and skins: semi – finished
- Chrome tanned hides and skins: semi – finished
- Sole leather, picking band leather, leather pickers and other accessories for textile industry, harness leather, leather shoes, shoe uppers, leather sandals and chappals, leather garments, suit cases and travel goods, purses, handbags, fancy leather goods, watch straps, cases and covers of all types, industrial gloves and washers and laces.

Leather Products

a. Leather Footwear
b. Leather Garments & Clothing
c. Leather Furniture
d. Leather Decorative
e. Leather Chemicals
f. Fashion Jewelry
g. Leather Accessories
   - Leather Bags

- Leather Wallets
- Leather Purses
- Leather Cases

Byproducts Manufacturing

a. Activated Carbon Manufacture

Leather waste may be used to produce activated carbon, the following leather wastes can potentially be used to produce activated carbon:

– Splits
– Blue trim and shavings
– Unfinished leather trim
– Finished leather trim
– Leather product manufacture trim and shavings

b. Glue-stock

Leather trimmings from untanned hides and skins and fleshings, used in the manufacture of gelatine and glue.

c. Fertilizer Manufacture

Lesser amounts of beam house solid wastes, such as fleshing, are also used as fertilizers. Processed fleshing can be applied to agricultural soils prior to panting. The fleshing releases their nitrogen as soil microorganisms slowly decompose the proteins in the fleshing. Mixture of fleshing with appropriate bulking agent (also carbon source) and aeration can lead to compost production, which can be used as fertilizer. Also, hair recovered through a hair save process can be incorporated into existing composting processes, as it is a valuable source of nitrogen and organic carbon.

d. Collagen Product Manufacture

Collagen is a fibrous protein that is the major constituent of animal skin or hide.
Waste hide materials, both tanned and untanned resulting from leather tanning operations, are sporadically used to produce collagen products. These waste materials include:

– Fleshings
– Trimmings
– Limed splits
– Blue splits
– Blue trim and shavings
– Unfinished leather trim
– Finished leather trim
– Trim and shavings from leather products manufacture.

Following fibrous products can be manufactured from the leather solid waste;
– Leather-board
– Artificial leather
– Poured insulation manufacture.

e. Secondary Leather Products Manufacture

An alternative to the disposal of leather scrap produced in leather and leather products manufacturing processes is to use it as raw material for smaller leather products. These secondary leather product manufacturers can use the following wastes:

– Splits (from chrome tanning)
– Unfinished leather trim
– Finished leather trim
– Leather product manufacture trim and
– Surplus and off-specification leather and products.

These wastes can be used in the manufacture of gloves, glove lining, eyelets, wallets, purses, sandals, trim for shoes, diaphragms for pumps and spray cans, and identification tags for luggage.

f. Use in Concrete Industry

The solid leather wastes could as frost-proofing air entrainment agents for concrete laid regions. The wastes suggested for the use are:

– Hydrolyzed hair
– Blue trim and shavings
– Buffing dust
– Unfinished leather trim
– Finish leather trim
– Trim and shavings from leather product manufacture.

g. Use as Sludge Conditioner

The following wastes could serve as conditioners and/or viscosity modifiers:

– Blue shavings and dust
– Unfinished leather trim
– Finished leather trim
– Buffing dust.

These wastes, acidic and fibrous in nature, act as flocculating agents when added to the basic sludge. The dust is especially effective due to its greater available surface area.

h. Methane Production

Un-tanned wastes mixed with farming wastes can be used for methane production.

i. Grease and Protein Recovery

Hydrolysis leading to the recovery of animal grease and proteins can be achieved in two ways; either by a liquid hydrolysis (acid or alkaline), or by enzymatic digestion at 35°C.

Export Market

Large- scale units are permitted to enter the field subject to licensing and export obligation of 75% of production. A few footwear units have been established on this basis.

Besides catering to the domestic market mainly confined to footwear, the leather industry has been registering creditable performances in the export front also. After textile, gem and jewellary and engineering industries, leather industry earns valuable foreign exchange to the country.

The leather and shoe industries and business can be broadly classified as under:

- Big groups having their own large tanneries fully equipped to process hides and skins from raw to finished stage, shoe units and own Effluent Treatment Plants (ETPs) - Category- I
- Tanneries capable of processing raw to finished leather with one or more finishing facilities, doing predominantly their own processing and occasionally job working and having their own ETP or connected to Common Effluent Treatment Plant (CETP) - Category -II
- Tanneries processing raw to EI tanned and raw to wet blue tanned leathers doing job work for others and connected to CETP- Category -III
- Merchant tanners who have no tanneries but doing leather business- Category -IV
- Small job working shoe uppers units working for big shoe units – Category -V
- Dry processing units, having one or more finishing facilities and mostly doing job work – Category -VI
- Tiny shoe units (cottage units) producing shoes out of export rejects of leathers and shoe uppers- Category-VII

- **Markets for Semi-finished leather**

With the exception of forward integrated large scale tanneries, all other tanneries process and sell semi-finished leather, that is, E1 tanned leather in crust form and chrome tanned leather in wet blue (WB) form. The major markets are Chennai, Mumbai, Delhi, Kanpur, Agra and Calcutta. The buyers, if they happen to be product manufacturers, carry out finishing processes on semi-finished leather, as required for the end uses, in their factories or elsewhere. Other buyers, who are basically traders, convert such leathers into finished leathers, with one or more processes in job working dry units, to suit the market demands.

The basic reasons for marketing leather in semi-finished form are:

(i) Finishing processes vary according to the requirements of end use.
(ii) Not all finishing processes are carried out on all leathers. Depending upon the type of leather required for a specific end use, semi-finished leather is subject to one or more finishing processes.

- **Finished leather for footwear industry and other products**

Sale of finished leather in local markets is very limited against specific orders. However, in Indian leather Industry sector there is a strong linkage between manufacturers and users of leather without intermediary commission agents.

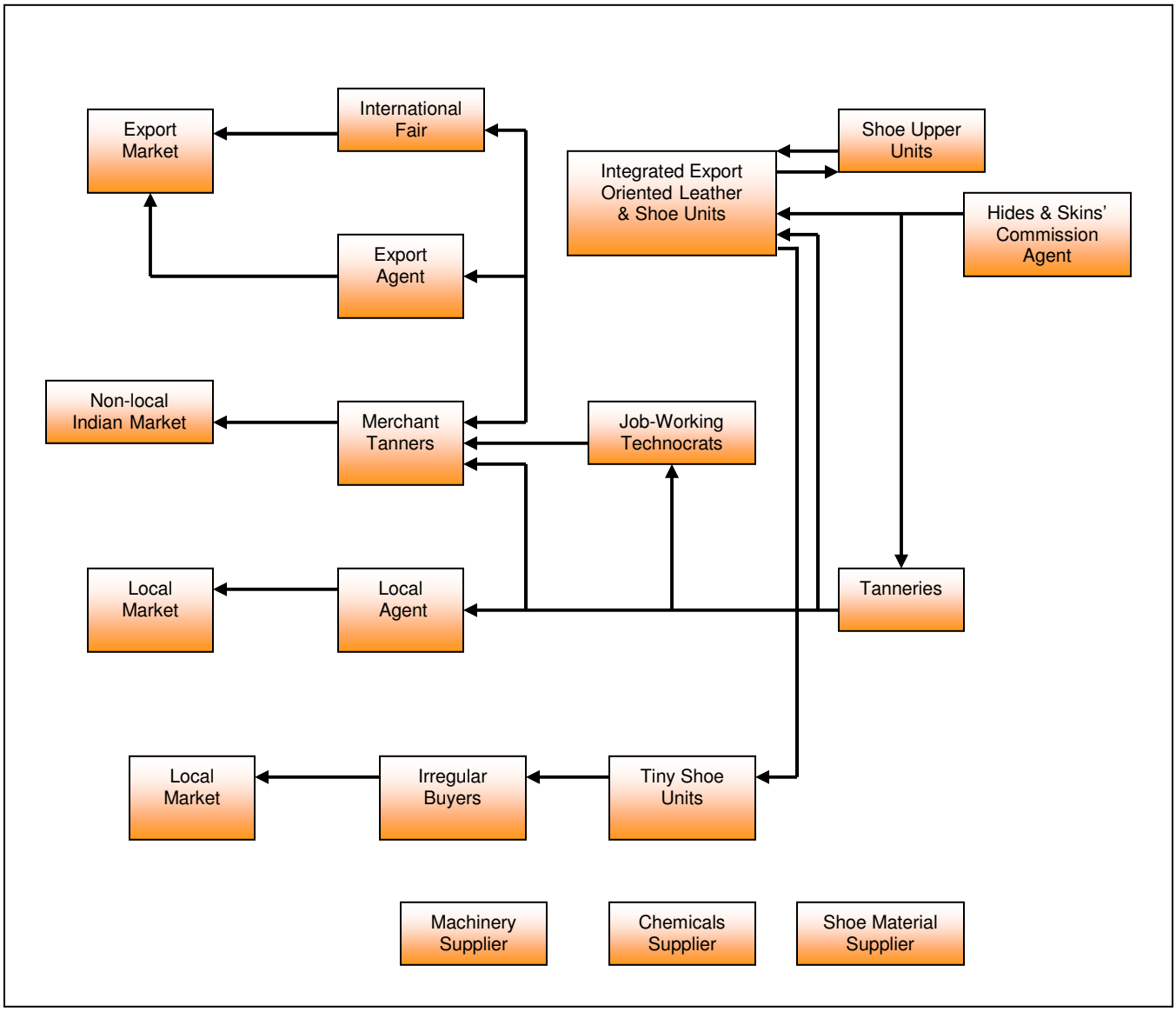
- **Finished leather exports**

There are a number of medium scale tanneries who have developed high quality finished leathers and doing well in export markets. Suede leather export was very buoyant for more than a decade. Of late footwear and products made of suede leather are losing their charm and consequently there has been a sharp decline in demand for suede leather. This development has put many tanneries in a quandary. They are now in a dilemma and laboring hard to develop new types of leathers which can help them to regain the lost ground.

- **Omnipresent Agents**

Commission agents in leather business are omnipresent. They take away a lion's share of the value added by leather industry-first in the supply of raw hides and skins and then in the marketing of semi-finished and finished leather.

Trade Links for Leather Sector



Trends

Leather and its allied industries contribute to one of the major industrial pollution problems facing the country, the water and air pollution by various processes from the slaughterhouse and the pollution causing chemicals, viz. lime, sodium sulphide, salt, solvents, etc. arise mainly from the pre-tanning processes of leather processing. In order to overcome the hazards caused by the slaughterhouse and tannery effluents, use of new techniques as a viable alternative has been resorted to in slaughterhouse and tanning operations.

In slaughterhouses, the environmental impact of waste can be greatly reduced by employing simple new methods and technologies:

- Waste prevention. Dry rendering of offals reduces the amount of waste water produced, and therefore processing costs. Cutting down on water use is probably the most important factor in reducing the environmental burden of slaughterhouses. Wastes

should, as far as possible, be collected as solids because blood and paunch, and other solids, contribute enormously to the waste water load and should not be washed away;

- Use of by-products. Slaughterhouse wastes can be composted and used as fertilizer. Anaerobic treatment results in a slurry that can be used as animal feed, the liquid part can be used as irrigation water, or for fish or algae production.

The quantity of pollution load generated by the leather industry can be reduced by using environmentally friendly production methods and technologies.

- Process modification to reduce the generation of waste and pollutants in the beam house;
- Reuse of chemicals (mainly sulphides and chrome) and spent liquors.
- Economical use and reuse of water;

The modified techniques required to apply on leather making processes to make it environmentally friendly are described below.

Desalting and soaking

The salt load in the effluent can be reduced by:

- Decreasing the amount of salt used to preserve hides by adding environmentally acceptable anti-septics such as boric acid and sodium sulphide. It must, however, be mentioned that the use of these preservatives reduces shelf life.
- Use of improved methods of desalting by using Dodeca frames and desalting machines.
- Processing fresh (green) hides, which have been preserved by chilling.

a) **Unharing and liming**. The pollutants from these processes can be reduced by using the following technologies:

- Recycling spent float. This also leads to a reduction in the amount of water consumption.
- Enzymatic unharing. This can lead to a reduction in the use of sulphide, leading to a reduction of COD by 30-40%.

b) **Deliming and Bating**. The environmentally friendly alternatives include: ammonia free deliming and batings and carbon dioxide deliming.

c) **Chrome tanning**. Cleaner technologies to reduce chrome content in the effluent are:

- High exhaustion process in which short floats at higher temperature and pH are used. The process increases the extent of chrome exhaustion and reduces the chrome content in the effluent.
- Recovery/recycling of chrome. In this process, chrome in the effluent is recovered and reused in tanning process.
- Low or no chrome tanning.

d) **Post Tanning**. The methods to reduce the load of pollutants generated by these processes are:

- High Exhaustion
- Chrome fixing in neutralization
- Chrome precipitation.
- Replacing nitrogenous compounds with other filling agents;
- Phasing out environmentally hazardous chemicals with high COD and BOD values, and limited biodegradability.

e) **Finishing**. A reduction of volatile organic compounds can be accomplished by using aqueous finishes for base and middle finish coats.

References

- *UNIDO Report 2001: The Leather Global Value Chain Review*
- *UNIDO Report: Leather & Leather shoes cluster of Ambur*
- *Cleaner Technology Programme for Korangi Tanneries: Data Review and Update Report May 01, 2003.*
- *Case Study Of The Leather Industry In Tamil Nadu*
- *International Union of Environment (IUE) Recommendations on cleaner Technologies for leather production. Updated October 2004 document.*
- *Report on Capacity Utilization and Scope for Modernization in Indian Tanning Industry, Central Leather Research Institute, Adyar, Chennai, 1990.*
- *http://www.fao.org./ag/aga/lspa/LXEHTML/tech/ch5d.htm*
- *Barriers and Opportunities for Promoting Trade in Environmentally Friendly Products- A Study of India's Leather Industry – Draft May 2002.*

Asia Pro Eco Programme

Is a five years programme launched by European Union in 2002, The main target is to adopt policies, technologies, and practices that promote cleaner, more resource efficient, sustainable solutions to environmental problems in Asia. The programme provides support through grants to policy reinforcement, operational and practical dialogue, diagnostic studies, technology partnership and demonstration projects, in the field of environment. The programme supports non profit organizations from EU and Asia.

About SINET

The aim of sustainable industrial network and its application on micro regional environmental planning is to interpret and adapt an understanding of the natural system and apply it to the design of the man-made system, in order to achieve a pattern of industrialization that is not only more efficient, but which is intrinsically adjusted to the tolerances and characteristics of the natural system. An industrial system of this type will have built-in insurance against environmental surprises, because their underlying causes will have been eliminated at the design stage. A micro-region is a distinct territorial unit with clearly marked boundaries below the regional level, but above the village level. Micro-regional environmental planning attempts to coordinate the planning activities of the various actors within a limited territorial unit.

The project will look at analyzing and documenting various success and failure stories of industry networks from Sweden/Europe and India/Asia, and to ascertain their impacts on environment and sustainability aspects of the respective micro regions. Emphasis will also be placed on creating awareness on the influence of industry network (key economic activity) on the micro region's environmental and sustainability aspects.

Contact Us
SINET Secretariat
c/o Network for Preventive Environmental Management (NetPEM) Public Trust,
301, 3rd Floor, Samved Sankul, Temple Road, Civil Lines,
Nagpur – 440001, India.
Phone: +91- 712 – 2552725/26, Telefax: +91- 712 – 2562723
Email: coordinator@sinetinfo.org Project Home Page: www.sinetinfo.org