

Figure 2: Future state of Map

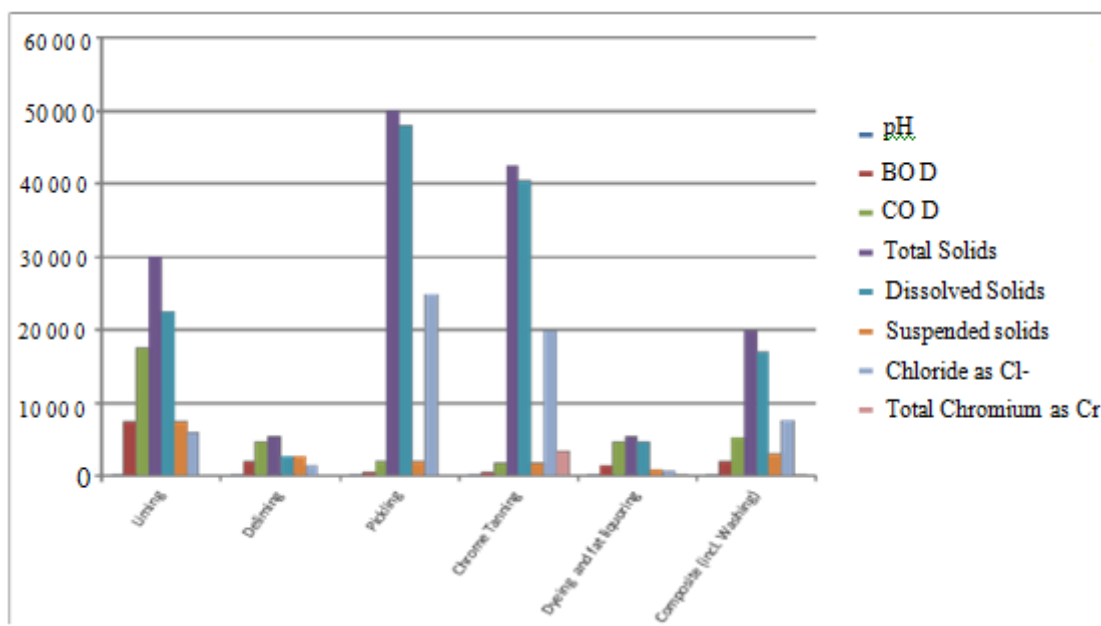


Figure 3: Characteristics of Tannery wastewater

Table 2: Water consumption before and after VSM (Water consumption for 1 t raw hides/skins processed to tanned leather)

Process	Convention al(kL)	Advanced	%of reduction
Soaking	12.0	4.7	61
Liming	6.0	3.6	40
Reliming		0.84	86
Deliming	1.5	0.2	87
Pickling& Chrome	1.8	0.21	88
Chrome Tannin washing	7.5	3.5	53
Total			
Without washings	21.3	8.71	59
With washing	28.8	12.21	58

The results show a reduction in the chemical and water usage and savings in the production cost.

The observations are: An increasing recognition that end-pipe treatment, in isolation is not an adequate strategy to

meet the requirements of wastewater norms and standards. Strategies for pollution prevention and control need to integrate cleaner process options with the better water management practices. The volume of effluent has a direct bearing on the cost of end-pipe treatment. The reuse of spent solutions after removal of the unwanted materials forms an integral part of in- process control strategy.

The ideal approach is to target the zero or near zero discharge of waste liquors. The progressive adoption of cleaner technologies by the tanners depends on the following factors: a) Proven reduction of emission loads in terms of quantity and quality; b) quantifiable economic benefits to tanners through quality improvement, cost reduction and material saving; c) ease of application with minimum additional investments hardware and d) trade advantages on account of improved environmental positioning in the global market.

The quantity of chemicals was reduced by 40% through the application of advanced technologies. This resulted in cost saving of US\$31 for processing 1 t of raw hides. Closed

loop pickle tanning has lead to savings of US\$30, due to savings in post tanning chemicals.

## 6. Supply Chain Management

Supply chain management (SCM) promotes the integration between companies and their suppliers through the development of supplier partnerships and strategic alliances. Therefore, the set of practices selected to manage the relationships with suppliers, named by up- stream supply chain (SC) practices, is a critical issue, since it affects companies and overall SC performance. The growth of industrial activity in leather sector has increased demand – pull for raw hides and skins. The supply of raw hides and skins however is related to the demand for meat and meat products on the one hand and extent of recovery of fallen animals on the other. Since the primary producer of raw hides and skins sourced from Indian live stock is weakly coupled to the tanning industry, inadequate attention of raw hides and skins management could cause loss of quality or raw materials. Typically Indian tanning industry invests about Rs 80 billion annually on raw hides and skins. It is estimated that about 800,000 people are involved in collection of raw hides and skins. The supply chain involves a large number of traders and middle men. An integration of meat handling leather sector could well ensure a better and equitable sharing of economic benefits from the animal breeders, people engaged in meat handling and tanners. Systems with leather sector could well ensure a better and equitable sharing of economic benefits from the animal breeders, people engaged in meat handling and tanners. This helps the human development within the community.

Animal has formed an important renewable resource in the synthesizing of the rural economy. The chain involved in livestock holding is more complex in India compared to what is obtaining in the industrial countries. The typical system [4] used for trading is represented in Figure 4.0. The transportation routes of animals are shown in Fig 5.0.

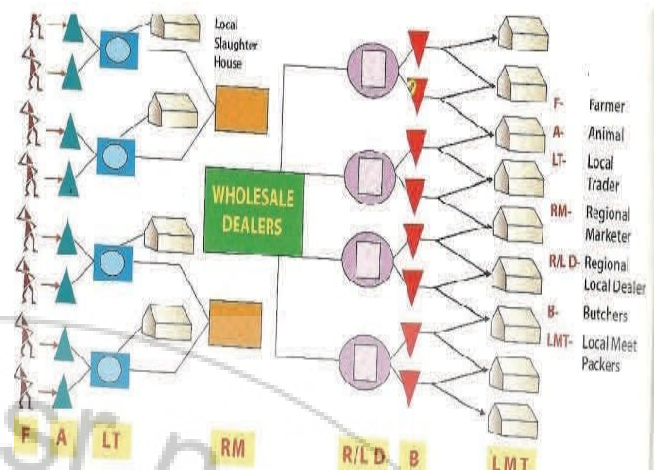


Figure 4: SCM in transporting animals to slaughter

SCM system is connected with enterprises on other nodes of the supply chain through Internet/Intranet. The system exchanges information with upstream suppliers through EOS (Electronic Ordering System) to realize pull type stock control on the upstream. It exchanges information with downstream retailers through DPR (Distribution Resource Planning) system to realize the drive-type stock control on the down- stream. Through this system, clients can check the goods in the warehouse, on the way and receiving status at any time, any place conveniently, at real time and correctly, and carry out online settlement. Conformity on capital flow, materials flow and information flow has been emphasized on the design characteristics of the system to highly integrate information of enterprises on upstream and downstream so as to form smooth SCM mode.

## 7. Green Supply Chain Management (GSCM)

Green SCM is getting more attention as a sustainable development mode for modern enterprises and is increasingly a part of Corporate Social Responsibility (CSR) initiatives. Green supply chain best practices are align green supply chain goals with business goals, evaluate the supply chain as a single life cycle system, Use green supply chain as a catalyst for innovation, focus on source reduction to reduce waste.

Green management system comprises of environmental management systems (ISO 14001 certified), Green waste reduction techniques comprising of process , product redesign, reduce, ,remanufacturing, that leads to good business results in terms of costs, lead times, quality, market position, reputation. Information technology can enable reduction in resources usage while executing business processes.

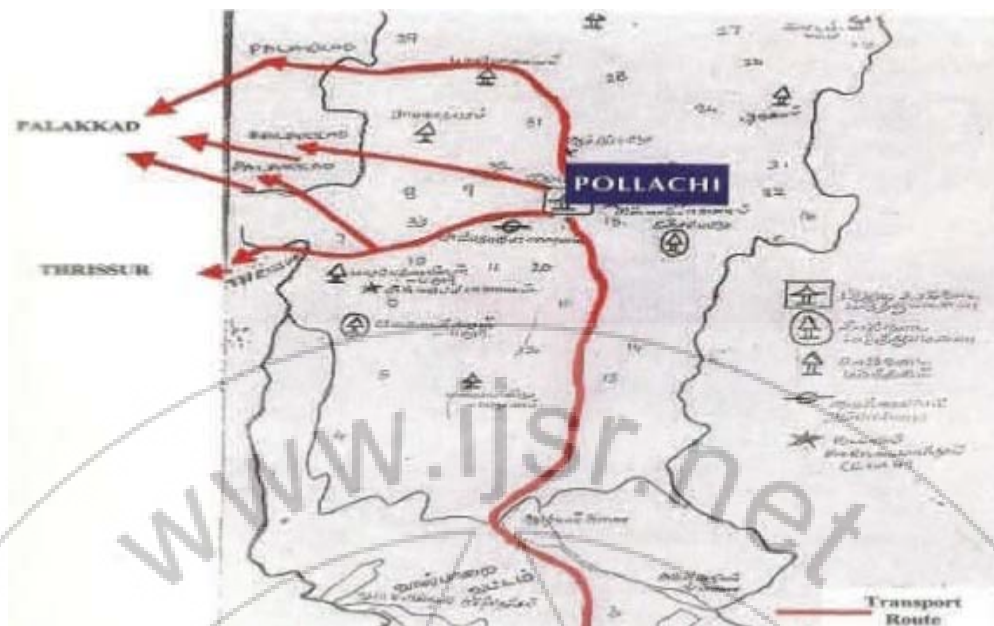


Figure 5: Pollachi to Keralla - Transport route of Animals

The GSCM = Green purchasing + Green manufacturing/materials management + Green Distribution / marketing + Reverse logistics.

## 8. Chemical Leasing (ChL)

UNIDO defines "Chemical leasing is a service-oriented business model that shifts the focus from increasing sales volume of chemicals, toward a value-added approach". The producer mainly sells the functions performed by the chemical, and functional units are the main basis for payment. Within chemical leasing business models, the responsibility of the producer and service provider is extended and may include the management of the entire life cycle.

## 9. Conclusion

Leather Processing is an important activity in many developing countries. The process involved in making of leather remains traditional in many developing countries which resulted high environmental impact. Chemical Inputs into leather sector have to be thoroughly assessed for Life Cycle Analysis.

Disposal of unused leather products may pose challenges in future. Any sustainable development of the industrial sector like leather with global market is no longer limited only to technical and economic issues. Environmental economics as well as health and safety play vital role in greener economy. Process audit for eco-acceptance of chemicals employed in Indian leather sector is an essential step.

Lean and green improves business results. A model that integrates the two into one comprehensive program focused on reduction of all wastes (those targeted by Lean systems and those targeted by Green systems) can be the most effective and efficient path to long-term organizational sustainability. In Future the distinctions between Lean and Green systems will end and Zero Waste

Manufacturing will emerge as a new holistic manufacturing system. Elimination of all forms of waste is the new vision. Synergy is realized as aggressive efforts are put to reduce waste results in continuous efficiency, quality, service and environmental improvements.

The future direction of work lies in disseminating the knowledge acquired in the current findings of Leather processing by the experts at Central leather Research Institute, Chennai which covers the following salient points:

- Maximum concern for environmental and occupational health factors to achieve sustained development
- Highest quality coupled with consistency
- Minimization of material and energy wastages and maximum utilization of indigenous resources
- Water conservation through better management and recycle practice
- Minimization and speeding up of processing steps
- Quick adaptability to changing international market needs to retain the competitive edge
- Partial automation to enhance the capabilities and productivity of the human skills

## References

- [1] Cartwright, R. (2002). *Mastering the Business Environment*. London: Palgrave Macmillan
- [2] FELD, William. *Lean Manufacturing: Tools and Techniques, How to use them*
- [3] Recouping the wastewater: a way forward for cleaner leather processing, J. Raghava Rao, N.K. Chandrababu, C. Muralidharan, Balachandra Unni Nair, P. G. Rao, T. Ramasami, *Journal of Cleaner production* 11( 2003) 591-599
- [4] Report on All India Survey on Raw Hides and skins, Prepared for Central Leather Research Institute, Chennai , 2005

## Author Profile

**P. Latha** is currently working as Principal Scientist at Computer centre, Central Leather Research Institute, Adyar, Chennai, India. She has Major in Physics and more than 20 years of experience in Scientific Computing and Networking. Her current interest and research is on Technology enabled Education methods, ERP and Cleaner Technology for Leather Processing.

**Dr Inbasekaran S** is currently working as Senior Technical Officer at Bio Products lab, Central Leather Research Institute, Adyar, Chennai, INDIA and his current interest lies in Nano particle Impregnated, Bio-products and conducting materials, Development of Nano materials.

