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A STUDY OF OPERATIONAL PROCESS AT LEATHER TANNING INDUSTRY**KANAKA B****ASST. PROFESSOR****CHETANA'S INSTITUTE OF MANAGEMENT & RESEARCH
MUMBAI****M. JEYARATHANAM****EMERITUS PROFESSOR****BHARATHIAR UNIVERSITY
COIMBATORE****ABSTRACT**

The global demand for leather and leather products increase day by day, since the global population and the standard of living of people increase rapidly every year. The leather and leather products sector now represents one of the most important industrial sectors in India, significantly contributing to the national economy. Tanning is an integral part of the process of converting raw hides and skins into finished leather. The condition of leather tanneries is indicated by many operational aspects. The present study analyses different aspects of tanneries operations of the leather tanneries at Vellore district in Tamilnadu, India. To evaluate the variance and relativity between the prevailing condition in tanneries operations and the impact of the variable on the operations of tanneries relevant ratios and statistical tools like mean, standard deviation, t-test were used. The present study concludes that the important operational aspect of leather tanning industry at Vellore district are that the process and power outages are associated with existing condition of this industry.

KEYWORDS

operational process, leather industry, tanneries, clean technology.

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1. INTRODUCTION

With the growth in the purchasing power of people, there is always an increased demand for inexpensive leather. In developing countries, leather industry suffers from economic constraints. They suffer the inordinately high cost of capital or inflation rates. The leather processing industry is going through change due to global environmental regulations. In leather manufacturing, the most outstanding process is tanning. The production of finished leather from raw hides and skins can be grouped under three major operations, namely beam house operations; tanning operations; and, post- tanning operations.

Leather from Tamil Nadu is of superior quality and rich in global markets. In Tamil Nadu, tanneries are mostly concentrated in Vellore District. Major reasons attributed to this situation are availability of natural tanning materials from the forest of Javadu and Chittoor, sunny climate prevailing throughout the year is conducive for drying, and presence of Palar River to meet water intensive tanning processes. There is availability of good quality water in this District. The tanned leather has to be dried uniformly before it is exported. This prevents the formation of fungus on tanned leather. The presence of 'uniformly hot climate' provides a comparative cost advantage to the tanners, because they do not incur any expenditure on drying the tanned leather.

There are five main tannery clusters, all situated in Vellore District. These clusters are located in and around the towns of Vaniyambadi, Ambur, Pernambattu, Melvisharam and Ranipet (Loraine Kennedy 1999). Most of the productions in the tanneries of Vellore District are for the purpose of export. The tanneries in Vellore District are located on the banks of the river Palar in the long stretch from Ranipet to Vaniyambadi. Thus, a large number of tanneries were established on the banks of the river Palar, which contains sub-soil water. With the concentration of tanneries in Vellore District, Chennai served mainly as the outlet for tanned products, more or less a centre for collecting the leather and its shipment.

A small tannery turning out 1,000 tanned skins per day needs 10,000 litres of water every day. On the other hand, a large tannery tanning 10,000 skins per day requires 2,00,000 liters of water per day. However, the quality of water plays a very important role here. The tanneries in Vellore, Ambur, Pernambattu, Ranipet and Wallajapet belt of the Vellore District process more than 700 tons of leather every day, accounting for 80 per cent of the leather produced in Tamil Nadu; and 40 per cent of the country. They earned more than Rs. 2,000 crores by way of foreign exchange annually (Report 1976).

2. OPERATIONAL PROBLEMS

Vellore district is one of the areas that contribute better part in the tanneries in Tamil Nadu. But, recently it faces several problems in its operations, such as infrastructure bottlenecks power failure and supply logistics which blocks the outcome of the leather industry (Shweta Singh & S. Rajamani 2011).

The process originally employed for tanning was a harmless vegetable process, which takes 40 - 45 days to complete. Pollution from tanneries became a problem when the tanneries switched over from Vegetable Tanning to the Chrome Tanning from the early seventies. Chrome Tanning requires a lot of water and yields waste water that requires treatment (Directory of Tanneries in India 2007). Tannery is a water intensive industry requiring enormous quantities of fresh water. Every 100 kilo grams of skin tanned use 32,000 litres of fresh water. The untreated effluents from tanneries are discharged on open lands or into the water sources thereby affecting the soil and groundwater as well as surface water causing serious environmental problems.

The tanning industry is linked to the functioning of sufficient environmental measures such as the setting up of primary and secondary water treatment plants. Cleaner Production is positive aspect to motivate factories toward seeking a joint solution to pollution control and increasing profitability (Ramjeawon 2004). In reality, expensive water treatment plants are commonly installed at huge supplier plants in the developing country but they have a tendency not to be used as they are costly to run due to high electricity and other maintenance costs.

The use of inefficient technology is largely responsible for the wasteful use of water and chemicals, high load of effluent pollutants and low productivity of the tanning industry. Whereas 80% of the industry is reserved for SMEs in the tanning sector from raw to semi-finished leathers with processing capacity of less than 1 to 2 tons per day Singh, Shweta and S., Rajamani (2007).

The leather sector is well known for its effluent problems. Treatment technologies in effect reduce pollutants in the liquid form and convert them into semi-solid or solid forms sludge can affect the quality of soil and groundwater, it is understandable that local authorities and governments should be concerned that the disposal of sludge to soils and dry wastes to landfill should not affect. Sequential washing is preferred instead of continuous washing to conserve water. This will lead to significant water saving and to a much reduced hydraulic load for the effluent treatment plant (Javed Ahmad Chattha and M. Mobeen Shaukat 2010).

A consequence of production expansion in some developing countries is that tannery input demands have outstripped locally available supplies and imports from the developed countries have become essential. It also motivates to augment raw material base, to enhance capacity, to address environmental concerns, human

resource development, to attract investment, to use modern technology and market of leathers globally (Satya Sundaram 2011). Global competition, e-business, the Internet, and advances in technology require flexibility and responsiveness.

3. OBJECTIVES OF THE STUDY

The study has the following objectives:

1. To study the existing situation of tanneries in Vellore district.
2. To study the respondents' attitude towards operational process of tanneries in the Vellore district.
3. To give suitable suggestions to improve the operations of tanneries in Vellore district.

4. RESEARCH METHODOLOGY

The study is an empirical research based on the survey method which involves both primary and secondary data. The primary data are collected directly from the tannery owners, managers and staffs. The data regarding the operations of tanneries were collected with the help of a questionnaire designed for this purpose. The present study is confined to leather tanning industry of the Vellore district. The tanneries from Ranipet, Melvisharam, Ambur, Vaniyambadi and Vellore formed the universe of the study. The population of this study was the 449 leather tanning industries at Vellore district. Totally 114 questionnaires are properly filled by respondents (*Tannery owners*) and was taken for analysis.

5. RESULTS AND DISCUSSION

Some of the operational problems faced by tanneries taken up for study are related to availability and purchase of raw material, improving product quality, policy initiatives by the government, recycling of industrial waste, proper storage, clean technology, scanning RFID, usage of process sludge, sequential washing, network service and adequate power for manufacturing process.

5.1 THE EXISTING SITUATION OF TANNERIES IN VELLORE DISTRICT

The tanneries in Vellore district are involved in producing raw leather; semi-finished leather and finished leather. It is observed that 15.8 per cent of tanneries in Vellore district produce raw leather, 20.8 per cent of tanneries produce semi finished leather and 47.3 per cent of tanneries produce finished leather and 16.7 per cent of tanneries produce semi-finished and finished leather. It is concluded that most of the tanneries in Vellore district undertake finished leather production. Though India boasts of the largest livestock population in the world, it still imports raw hides and skins and finished leather due to poor quality, high local costs and inadequate availability. For the cattle hides, Arrah, Aurangabad, Dhanbad and Patna are major markets and for cow calf skins, Muzaffarpur, Pabai and Patna are famous markets. A few well known Tamilnadu tanners have their own collection agents for hides and skins in important markets in Bihar.

The raw hides and skins are purchased from India and abroad for the tanneries. It is observed that 65.0 per cent of tanneries purchased raw hides and skins from India and 20.1 per cent of tanneries purchased raw hides and skins from only from foreign countries (Austria, Germany, Italy, Argentina, Singapore, and China) and 14.9 per cent of tanneries bought from both India and foreign countries. It is concluded that most of the tanneries are purchasing raw hides and skins from India only.

To compete effectively in the global market, tanneries have to cut down production costs and improve product quality by technological upgradation and by using better chemicals. The technological move towards chrome processing came at a time when market demand in industrial countries shifted toward the chrome and semi-chrome processed leather. The government has announced certain concessions on imported specified machinery and chemicals for the purpose of improving the quality of leather products. It is inferred that 53.5 per cent of the respondents have considered technological upgradation will cut down unit production costs/improve product quality to enable them to compete effectively in the global markets. 31.6 per cent of tanneries have considered chemicals will improve the quality and for 14.9 per cent of tanneries both technological upgradation and chemicals will improve the product quality.

The government has announced certain concessions on imported specified machinery and chemicals for the purpose of improving the quality of leather products. The government has withdrawn duty on export of raw hides and skins, semi-finished leather, and leather products to make the leather industry more competitive. The tanneries need policy initiatives to tackle the problems of uneconomic units, technological obsolescence and environmental compliance. It is understood that 11.4 per cent of respondents need policy initiatives to tackle the problems of uneconomic units, 67.5 per cent of respondents require for technological obsolescence and 21.1 per cent of tannery owners' need policy initiatives for environmental compliance.

Precaution in handling and storage of chemicals is necessary to prevent from release in to the air and spillage onto the ground, which will contaminate the soil and groundwater. Good administration will avoid storage of material for a long time. It is found that 100 per cent of respondents have knowledge about proper storage and handling of particularly hazardous chemicals.

Implementation of Cleaner Production (CP) options in tanneries includes the use of the most viable cleaner technologies for at-source pollution abatement and waste management. It is observed that 100 per cent of respondent agree that clean technology standards and the development and implementation of cleaner technologies rely on the idea that prevention is better than cure.

Hide are coded in the scanning sequence allowing the Radio Frequency Identification (RFID) number to match hide stamp. This provides tractability from the tannery and traceability of hides to the producer. It is found that 100 per cent of respondent had not used RFID and they do not agree that Scanning RFID and using the hide stamper proved is an effective method of hide identification.

The wastewater produced during tanning activities and excess sludge from biological treatment is called tannery sludge. The disposal of this sludge is one of the challenging problems for wastewater treatment plants. The foremost solution of tannery sludge disposal is landfills. It is revealed that 21.1 per cent of respondent said that tannery sludge is processed for composting / agriculture after appropriate assessment for contaminants and potential impacts to soil and groundwater and 78.9 per cent of respondents' have a contrary view in this regard.

It is observed that 93 per cent of respondents observed that sequential washing has been used instead of continuous washing to conserve water and 7 per cent of respondents disagree with it.

The leather industry network would comprise of the following: livestock (Cattle, Buffalo, Goat), slaughterhouses, raw Hide/Skin collection, tanning Industry, leather Industry, other allied industries and export market. It is understood that network service is not adequate for 77.2 per cent of respondents. However, 22.8 per cent of respondents are of the opinion that the network service is adequate at leather tanneries.

Tannery owners opined that unhygienic working conditions lead to health hazards for the workforce; the information sources about tanneries were the buyers, the CLRI, the CLE Website and leather magazines; vegetable-based tanning solutions can be substituted for chrome; institution of SIDO, SISI is helping tanneries to revive; tanneries are treated as priority sector by the government to help them financially; reservation of certain products for tanneries avoids competition from large-scale industries; technical tannery assistance is given to tanneries by the Government to increase production and state tanneries corporations ought to rationally distribute the raw materials during scarcity.

5.2 LEVELS OF ATTITUDE OF RESPONDENTS TOWARDS OPERATIONAL PROCESS OF LEATHER TANNERIES AT VELLORE DISTRICT

The respondents' attitude to operational process of prevailing situation, process, power outages and government policies is studied and presented by using parametric one sample t- test. The level of attitude of respondents towards operational management is measured by applying Likert type five-point scale.

5.2.1 ATTITUDE TO PREVAILING CONDITION OF TANNERIES AT VELLORE DISTRICT

The tannery owners' opinion related to availability of skilled labour force, amount of water for processing leather, facilities provided by government to improve the quality of domestic environment by trade liberalization, facilities for treatment and disposal of hazardous wastes, working conditions for the workforce, facilities for quality testing, utilization of training centres by tannery employees, modernization of tanneries, the information sources about tanneries have been computed from the mean score. The present study has made attempts to analyze the respondents' attitude to prevailing condition of the tanneries by using one sample t-test. Table 1 presented the parametric t-value for the prevailing conditions of tanneries in Vellore district.

TABLE 1: ATTITUDE OF RESPONDENTS TO PREVAILING CONDITIONS

Sl. No.	Attitude of Respondents to Prevailing Conditions	N	Mean	Std. Deviation	Std. Error Mean	t-Value	Significance
1	Tanneries have availability of skilled labour force.	114	3.5614	1.27630	.11954	4.697	.000
2	All tanneries need large amount of water for processing leather and depend on ground water sources for their daily requirements.	114	3.9912	.92646	.08677	11.423	.000
3	Government should be a facilitator to improve the quality of domestic environment by trade liberalization.	114	3.0789	1.28397	.12025	.657	.513
4	Sufficient facilities are available for treatment and disposal of hazardous wastes.	114	3.4386	1.02219	.09574	4.581	.000
5	Unhygienic working conditions lead to health hazards for the workforce.	114	4.3070	.63979	.05992	21.812	.000
6	Facilities for quality testing are sufficient.	114	3.9912	.87740	.08218	12.062	.000
7	Training centres are utilized by tannery employees.	114	3.5526	1.20539	.11289	4.895	.000
8	Modernization of tanneries with increased capacity would be cost effective.	114	3.6754	.90716	.08496	7.950	.000
9	The information sources about tanneries were buyers, the CLRI, the CLE website and leather magazines.	114	4.0789	.91347	.08555	12.611	.000
10	Tannery industry is capable of increasing its capacity.	114	3.5088	1.48887	.13945	3.649	.000

It is observed from the table above that the mean value of the prevailing condition of tanneries ranges from 3.0789 to 4.3070 with consistent and varying standard deviation. The t-value of 10 variables are 4.697, 11.423, .657, 4.581, 21.812, 12.062, 4.895, 7.950, 12.611, 3.649. The t-values are statistically significant at 5 per cent level for all variables except the t-value for the variable 'Government should be a facilitator to improve the quality of domestic environment by trade liberalization' is not significant.

The respondents strongly agree with the variables 'Unhygienic working conditions lead to health hazards for the workforce'; 'The information sources about tanneries were the buyers, the CLRI, the CLE Website and leather magazines'.

5.2.2. RESPONDENTS' ATTITUDE TO OPERATION PROCESS OF TANNERIES AT VELLORE DISTRICT

The present study has made an attempt to analyze respondents' attitude to operation process of the tanneries by using one sample t-test. The tannery owners' view related to price variation of raw material, absolute scarcity of raw materials, poor quality raw materials, government agencies regarding raw material supply, open market purchase of raw materials, improper design and maintenance practices, efficient chemical, use for modular production, value chain efficiencies, chrome tanning, online process control mechanism, efficiencies in usage of energy, chemicals and water capacity were taken.

The results of respondents' attitude to operation process of the tanneries are given in the table 2 which shows the mean value and parametric t-value of the operation process of tanneries in Vellore district.

TABLE 2: ATTITUDE OF RESPONDENTS TO OPERATION PROCESS

Sl. No.	Attitude of respondents on operation process	N	Mean	Std. Deviation	Std. Error Mean	t-value	Significance
1	Price variation of raw material very often affects the performance of Tanneries.	114	2.8158	1.19413	.11184	-1.647	.102
2	The absolute scarcity of raw materials leads to closure of industry.	114	3.1842	1.29373	.12117	1.520	.131
3	Poor quality raw materials affect the image of the products produced.	114	3.2719	1.35206	.12663	2.147	.034
4	There is no special staff to deal with Government agencies regarding raw material supply.	114	2.9386	1.35206	.12663	-.485	.629
5	Open market purchase of raw materials increases the production cost.	114	3.2807	1.34696	.12615	2.225	.028
6	Improper design and poor maintenance practices result in exposure to high levels of noise.	114	2.7368	1.24838	.11692	-2.251	.026
7	More efficient chemical use can both lower production costs and reduce pollution.	114	3.3684	1.38426	.12965	2.842	.005
8	For modular production, CAD/CAM and computer applications, aimed basically at achieving lower work in progress and shorter lead times.	114	3.2632	1.13709	.10650	2.471	.015
9	Vegetable-based tanning solutions can be substituted for chrome.	114	3.8684	.84679	.07931	10.950	.000
10	Cost competitiveness can be improved through value chain efficiencies.	114	4.0000	.77574	.07265	13.764	.000
11	Chrome tanning requires less processing time than traditional vegetable tanning.	114	4.1228	.85332	.07992	14.049	.000
12	There is need to emphasise product consistency through online process control mechanism which involves modernisation of all interfacing systems, efficiencies in usage of energy, chemicals and water capacity.	114	3.4474	1.09780	.10282	4.351	.000

It is understood from table 2 that the mean value of the respondents' attitude to operation process of tanneries ranges from 2.7368 to 4.1228 with consistent and varying standard deviations. The t-value of 12 variables are -1.647, 1.520, 2.147, -.485, 2.225, -2.251, 2.842, 2.471, 10.950, 13.764, 14.049, 4.351. The t-values are statistically significant at 5 per cent level except the variables 'Price variation of raw material very often affects the performance of Tanneries'; 'The absolute scarcity of raw materials leads to closure of industry'; and 'There are no special staff to deal with Government agencies regarding raw material supply'. The respondents strongly agree with the statements 'Chrome tanning requires less processing time than traditional vegetable tanning' and 'Cost competitiveness can be improved through value chain efficiencies'.

5.2.3 RESPONDENTS' ATTITUDE TO POWER OUTAGES OF TANNERIES AT VELLORE DISTRICT

The present study attempts to analyze respondents' attitude to power outages of the tanneries. The tanneries' owner's views about power supply, installing alternatives like generators and thermal power units were considered. Table 3 explains the parametric t-value for the respondents' attitude to power outages of tanneries in Vellore district.

TABLE 3: ATTITUDE OF RESPONDENTS TO POWER OUTAGES

Sl. No.	Attitude of respondents on Power Outages	N	Mean	Std. Deviation	Std. Error Mean	t-value	Significance
1	Power supply is not properly regulated.	114	3.3070	1.25597	.11763	2.610	.010
2	Only limited hours of power supply is given.	114	4.0263	.95436	.08938	11.482	.000
3	Within the limited hours of power supply, it is difficult to complete the production.	114	3.9211	.88392	.08279	11.126	.000
4	Many labour hours are wasted and unutilized during power – cut.	114	3.8684	.84679	.07931	10.950	.000
5	Tanneries cannot go for installing alternatives like generators and thermal power units.	114	3.7105	.92864	.08697	8.169	.000
6	Time management to maximize the production within the specific hours is highly difficult.	114	3.4649	1.22785	.11500	4.043	.000
7	Captive power in Tamilnadu plant leads to fluctuation of power affects the tanneries.	114	3.5877	.97592	.09140	6.430	.000

It is observed from table 3 that the mean values of the respondents' attitude to power outages of tanneries range from 3.3070 to 4.0263 with consistent and varying standard deviations. The t-value of 7 variables are 2.610, 11.482, 11.126, 10.950, 8.169, 4.043, 6.430 showed that all the 7 variables are statistically significant at 5 per cent. The respondents strongly agree with the variable '*Only limited hours of power supply are given*'.

5.3 BASED ON THE FINDINGS OF THE STUDY THE RESEARCHER HAS DRAWN THE FOLLOWING RECOMMENDATIONS

Scanning RFID and using the hide stamper can be an effective method of hide identification, even though it interrupted the workflow significantly. Proper design and maintenance procedure may reduce high levels of noise. Clean technology standards can be implemented, which relies on the idea that preventing is better than reusing. Modernization of tanneries with increased capacity would be cost effective. Tanneries can go for installing alternatives like generators and thermal power units to overcome power outages. Government should be a facilitator to improve the quality of domestic environment by trade liberalization. Tanneries can be encouraged to be private limited. Its innovative technologies are essential for protecting the leather tanning industry from consequences. Another area of study identified was on the excellence of process improvement in leather tanning industry.

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