Chapter VI

CONCLUSIONS AND IMPLICATIONS

A brief summary of the scope and methodology of the present study and its finding is presented in this chapter. Conclusions are drawn, and their policy implications are stated.

THE PROBLEM FOCUS

In the light of global concern on ‘Green House effect’ and the growing awareness among the people about the environmental problems the findings of the study would have policy implications. Moreover in the recent years environmental issues have drawn in the attention of scientists, social scientists, economists, policy makers, researchers and others. The concept ‘Tragedy of commons’ reveals that the environmental goods are public goods having the features of non-rivalry and non-excludability resulting in misuse and overuse of environmental resources. They should be used to get maximum welfare. The goods are becoming scarce by the damage caused by pollution.

This situation necessitates the distribution of scarce resource among the present and future generation in an equitable manner. The exploitation of non-renewable resources by present generation would impose stress and strain on future. Equitable distribution leads to justice, employment, health facilities, education and healthy environment. The state of sustainability could be easily achieved by inter-temporal distribution, otherwise overuse and misuse of environmental resources results in the state of Unsustainability. At this stage there would be swelling population 3 billion more by 2025, rejuvenation, income inequitability breakdown and developing country growth.
In India, industrial production has gone up by fifteen fold since independence, simultaneously throwing up a plethora of pollution problems. Tannery is a major source of pollution but it is also important for the large amount of foreign exchange earned by it. The 2625 tanneries in India earned Rs.8,720 crore of foreign exchange in 2002-2003. Those tanneries provided employment to about 89650 workers. But they discharge 465 million liters of effluent. The toxic effluent discharged by the tanneries had by 2002-2003 converted more than 50680 hectares of agricultural land into barren land. People living in tannery belt and surrounding area are severely affected by several diseases. Tanks, wells, lakes and rivers are polluted and the water is not safe for drinking. Open discharge of effluent into the environment causes air pollution also. Pollution control board advised the tanneries to install individual effluent treatment plants to treat the effluent of having sustainability of tannery. But tanneries have not done it because it involves huge investment. So the common effluent treatment plants were suggested as a cost effective method, still the problem persists. Several attempts have been made to assess the damage caused by tannery pollution to the environment. Most of them have concentrated on one aspect or the other of pollution and are not comprehensive. Particularly, not much work has been done on the economics of control of environmental pollution by tanneries. Pollution creates the problem of externality and its prevention is an obligation of a welfare state. This would also lead to sustainability of tannery increasing welfare of the people. This requires knowledge of economics of environmental damage and the cost of pollution control i.e. to sustainability. The present study is an attempt to meet this need.

**OBJECTIVES OF THE STUDY**

The overall objective of the study is to analyze the impact of tanneries on environmental qualities with emphasis on externalities and sustainability.
Specific objectives of the study are
1. To study the extent and types of environmental pollution caused by tannery effluent.
2. To quantify and measure the economic values of the losses on crop production, value of properties, quality of drinking water and health hazards caused by tannery pollution.
3. To estimate the cost of abating (preventing) and of compensating (neutralizing) environmental damages (pollution prevention principle)
4. To identify options for maximizing the net effects of pollution control on social welfare for its sustainability.
5. To suggest specific strategies, policies and social actions for solving the problems of tannery for sustainability.

The study includes analysis of the specific damages by tannery pollution on the health of humans, animals and other living things of the study area and also sustainability of the tanneries. Changes in the production of leather and discharge of effluent by switching to chrome tanning from vegetable tanning in augmenting production and causes for sustainability are also analyzed.

METHODOLOGY
Since tanneries are less in number, total numbers of tanneries are considered in Sempet as per report of 2005 and 2006; total numbers of tanneries are 14. Formerly there were 18 tanneries in 2001-2002. 4 tanneries have been closed due to want of effluent treatment plant. So at present only 14 tanneries are functioning in Sempet. So, 14 tanneries are taken into account for this analysis. Among them 6 tanneries are found in eastern side of Pudukkottai road and 8 are found in western side of Pudukkottai road, Therefore western side of tanneries in Pudukkottai road is considered as
group I tanneries and eastern side tanneries in Pudukkottai road is considered as group II tanneries based on place of concentration.

All tanneries were personally visited and the area damaged by tannery pollution was personally evaluated. The general observation was that the degree of pollution and the intensity of damage caused by it decreased as the distance from the tannery increased. It was measured by the toxicity of pollutants in tannery effluent discharged into the environment. To study the differences in the level of toxicity the area surrounding the tannery group unit was divided into three zones. First zone comprised the area within 2 km radius around the factory. Second zone included areas in the radius distance of 2 km to 4 km and the area beyond 4 km was included in the third zone. The third zone, therefore, served as a control to measure spatial differences in pollution and damage caused by it. So there were three zones to measure the extent and types of pollution that enabled follow the measures for improving the welfare of the people and sustainability of tannery.

Considering the resource constraints of an individual researcher, who had to work unemployed full-time and who had to personally enquire the sample workers and households respondents because of the nature of questions to be asked and the cross-checks necessary to minimize bias in reporting, the sample size was fixed as 184 households for group I and 138 household for group II tanneries. Therefore the ultimate sample consisted of 322 households. The sample was distributed among the zones as 64, 60 and 60 for zones 1 through zone III respectively for each tannery group unit. Required numbers of households in each zone were selected by simple random sampling method. The random selection allowed representation of all section of the population. Therefore, around eighty per cent of the sample
households were farm households and the rest included artisans, unskilled labourers, traders and other professionals.

Out of the 707 unskilled (permanent and temporary) workers of the tanneries 140 unskilled workers were also selected from three groups of units of tannery based on simple random sampling method in order to analyze occupation related diseases of the tannery worker.

The collected data were analyzed to know the damage costs of environmental pollution which included the value of damage to residential properties, human health and socio-psychological well-being. Components of environmental management costs are (i) depreciation cost of pollution control devices, their maintenance costs including an interest on the working capital for the maintenance (ii) expenses on welfare contribution, i.e., social security obligations (iii) cost of amelioration of damaged (cultivable) land (iv) medical care expenses on animal and (v) health care expenses of households. Pollution from tannery is the fallout from leather production process which contributes income, employment and other benefits to the area of the location. The major benefits are the following (a) net income generation (b) net monetary value of employment generated and (c) other benefits. Above components were appropriately quantified, measured and aggregated to estimate the two costs of damage and of prevention.

FINDINGS OF THE STUDY

Average production of a tannery in 2000-2001 was 1.96 tonnes per day, and it rose to one tonne per day in 2005-2006; it is an increase of 2.85 tonnes per day (146.43%). Average installed capacity of a tannery was 2.5 tonnes per day in 2005-2006. Average asset value of tanneries in 2005-2006 was
Rs.124.5 lakhs. An average annual liability of tanneries was Rs.68.00 lakhs, leaving a net worth of Rs.56.50 lakhs.

Total amount of leather produced in 2000-2001 was 10,012 tonnes, of which 8,055.95 tonnes (80.56%) was chrome tanned leather and 1,121.26 tonnes (19.54%) was vegetable tanned leather. In 2005-2006 total amount of leather produced was 14,537.95 tonnes. In that amount 13,065.05 tonnes (89.87%) were chrome tanned leather and 1,473 tonnes (10.13%) were vegetable tanned leather. Switching to chrome tanning increased the intensity of pollution.

Total quantity of effluent discharged was 330.859 lakhs liters in 2000-2001, of which vegetable tanned effluent was 48.900 lakhs litre (14.78%) and chrome effluent was 281.959 lakhs liters (85.22%). In the year 2005-2006, total effluent discharge was 494.133 (lakh liters) of which the share of vegetable tanned effluent was 7.46 per cent and that of chrome tanned effluent was 92.54 per cent. Pollution is more severe in 2005-2006 than in 2000-2001, because of switching to chrome tanning. Tolerable limit of BOD was 200 mg/lakh liter. But all the tanneries exceeded it, with discharge of more than 200 mg/lakh liters.

**Pollution control measures**

Since tanneries are responsible for environmental degradation it is essential on the part of the tannery to invest money on pollution control equipment and measures. During the year 2005-2006 tanneries invested Rs.178 lakhs, the Central govt. invested Rs.27 lakhs and the State govt. invested Rs.75 lakhs. So the overall total is Rs.280 lakhs.
Solar ponds were also constructed by tanneries to control tannery effluent at the cost of Rs.4,85,200 (4.852 lakhs). Total pollution prevention cost incurred by tanneries was Rs.19.570 lakhs. Besides that the tanneries spent on social welfare a sum of Rs.10.43 lakhs in 2005-2006.

Overall current annual expenditure of tanneries was Rs.133.17 crores in 2005-2006; annual capital expenditure was Rs.9.39 crores; annual other expenses was Rs.5.34 crores; adding up to total Rs.147.90 crores in 2005-2006. Total annual revenue was Rs.321.88 crores. Total net return of 14 tanneries was Rs.178.21 crores. Return over cost was Rs.2.40 crores.

Huge investment of capital is required to setup and run a tannery and that is a check on the number of tanneries in operation, giving the existing tanneries some market power in the sale of their product and the tanneries are highly profitable enterprises.

Total annual revenue obtained by tanneries in the year 2000-2001 was Rs.62.43 crores and it rose to Rs.141.3 crores in 2005-2006.

**Tannery workers**

The composition of the work force was very closely similar or different tanneries and the small variation of due to the differences in the production level. The temporary unskilled workers formed the most dominant group; followed by the temporary semi-skilled workers is third place. Unskilled permanent workers and semi-skilled permanent workers took the second and fourth place.

Tanneries employed temporary workers both semi-skilled and unskilled – to the extent of nearly 2.03 per cent of total number of workers. This
enabled the tanneries to avoid the payment of expenses on health care of such workers. While it was cost saving to the tanneries and hence desirable for maximizing profit, it had a social cost in the ill-health suffered by the workers. It was then an externality to be included in the environmental damage cost.

Total number of workers including technicians and managerial staff are 43-75 in group I, from 3472 in group-II. Unskilled permanent work force varied between 115 and 134 in group-I and group-II; unskilled temporary work force varied between 132 and 167 in group-I and group-II respectively. The number of Semi-skilled permanent and temporary workers varies from 36 to 48 and 6 to 8 in groupI and group-II respectively. So the grand total of workers in both groups is 765. Among the workers temporary unskilled and semi-skilled workers are greater than permanent unskilled and semi-skilled workers. The average is 52.38 workers in group I, and 57.67 in group II respectively.

It may be seen that the workers are mostly from SC and ST and sizable number of workers are also found in backward and most backward communities. Thus the workers in tanneries are socially backward or most backward, largely because the customs prevalent in Tamilnadu. In any way it is a hazardous work and only those who find no other avenue of employment join the work force in tanneries.

The employment of workers within the age group of 11-20 years were not significant. The mean age of workers employed in the tanneries was 31-40 years. So the mean age of the workers has also proved that majority has also proved that majority of the workers are youths or adults. It would show that either the job is of youth or a few of the youth who enter the tanneries never survive beyond 40 years.
Among the total number of 140 sample workers, majority (68.57%) of the workers are illiterate in the sense that they did not know to write or read in any language and could not even sign the receipts and affix thumb impression to receive payments. Only 31.43 per cent entered the schools but they have dropout before passing fifth standard. With this poor educational status the workers remain helpless in bargaining wages and other benefits including protection against health hazards. It was no surprise if they receive low wages. The tannery workers as a class were low wage earners. Usually more than one member of the family went to work. Thus employment in tanneries was the most important source of livelihood for the tannery workers’ family.

Income per worker per month ranged between Rs.2,501/- and Rs.3,500/- for 30.00 per cent of workers; Rs.2,001/-, Rs.2,500/- for 27.14 per cent, and Rs.3,501/-, Rs.4,500/- for 7.14 per cent. It was the major source of income to the worker households.

Among the 140 sample workers 7.14 were affected by respiratory diseases, 25.00 by dermatitis, 21.43 by conjunctivitis, 16.43 by night blindness, 8.57 by leprosy and 11.43 by oligospermia – all tanneries related diseases.

**Damage to health of workers**

Tannery pollution caused diseases not only to the workers but also to the members of their household on account of this the workers incurred several losses. First loss was the loss of workdays due to prolonged illness and incidence of diseases. It was a loss of work of five days for permanent workers and seven days for temporary workers.
It was valued by their average wage per day for days they worked. This worked out to Rs.982/- and Rs.861/- per worker for permanent and temporary workers respectively for a year. The total cost of damage to the health of the workers and their families caused by the working condition and environment pollution of the tanneries was as high as Rs.574.46 crores. It worked out to Rs.3.95 lakhs per tonnes of production at the current aggregate production level of 14,537.95 tonnes per year for all the 14 tanneries.

The damage due to pollution of tannery effluent was seen in farms, livestock and properties of rural households. The larger the discharge; longer the distance that the effluent ran off the tanneries. As a result the land, water and properties damaged by the tannery effluent extended to a very long distance, but the intensity of damage declined as the location was far off from the tanneries.

**Damage to cultivable land**

In zone I (area within 2 km radius around the tanneries) the damage was near total 100 per cent for group-I and group-II tanneries. In the area of 2 to 4 km radius of the tanneries also, the damage was heavy at 74.32 and 69.54 per cent for group-I and II respectively. Only in areas beyond 4 km from the tanneries, the damage was small; 29.09 per cent in group-I and group-II. Farmers who had suffered damage to the fertility of the land due to effluent discharged by the tanneries, had to incur on an average Rs.2,306/- per ha for correcting the damage.

**Damage to value of land**

Even those lands not affected by pollution and continued to produce normal crops in a year of normal rainfall, lost their value in the market, just because they were located in the pollution shadow. The sample average loss
was Rs.77,500/- per ha for irrigated land and Rs.20,500/- per ha for rainfed land. This was again an externality to tannery production.

**Damage to irrigation water**

The farms in the study area received irrigation mostly from wells and a few rainfed tanks. Tannery effluents percolated to the water table and rendered the water unsuitable for irrigation. Less than 50 per cent of the affected area could be saved, because the cost of protection was very high. Where the work had been done the cost varied from Rs.2,950/- per ha in zone III to Rs.5,125/- per ha. In zone II the sample average being Rs.5,117/- per ha.

**Decline in crop yield**

Overall crop loss in the area polluted by the 14 tanneries of sempet in Tiruchirappalli City Corporation was Rs.16.63 crores. Suffered by the farmers who were not only poor but also did not know any other art. This was therefore a social loss and an externality to the tanneries. Thus farmers in tannery affected area suffered several damages, such as loss of entire land (becoming unfit for cultivation); partial loss of quality of soil, loss of irrigation water from polluted wells, cost of preventing it, loss of market value of land and the loss of crop income. These losses were not compensated and remained an externality.

**Damage to livestock**

The pollution by tannery effluent affected both the health of the farm animals and their productivity. Livestock suffered from several diseases and some of them were fatal.

Among the 322 sample households were having livestock totally numbering 1008. Among them 211 households reported damage to their number of animals affected by diseases was 5%. The damage by tannery pollution to the health of the animals was lesser; the further was the location
of the area from the tanneries. When the animals suffered from diseases and the households had to spend on medical treatment of the animals, it might be a source of discouragement for the maintenance of animals. This fear was found to be genuine. Thus tannery pollution was seen to have discouraged livestock production and its implication was that the households suffered the loss of income and employment potentials. This was the second damage to the livestock production due to tannery pollution. The average loss per household did not differ much between the groups – the value of loss of livestock production due to the damage (death, loss of weight and consequent decline in yield) by tannery pollution varied from Rs.1,013/- in zone III to Rs.2,992 in zone I, the average being Rs.2,021/- per year per household.

The value of animals lost by deaths was largest in zone I at Rs.6,74,500/- followed by Rs.5,20,500/- in zone II and Rs.18,300/- in zone III, again the differences being caused by the intensity of pollution.

The households had to spend on medical treatment of animals for the diseases caused by the tannery pollution. It was largest Rs.1,425/- in zone I, and decreased to Rs.1,000 in zone II and to Rs.435 in zone III. Therefore the cost of medical treatment of the animals also increased for households closer to the tanneries.

**Damage to drinking water**

A majority of 169 families (52.48%) reported non-availability of protected water. Some of them used water from wells, tube wells, and tank of nearby villages which were not polluted by tannery effluent. This involved cost of fetching water from distant places. Overall an annual average cost Rs.1,401.50 was spent by each household per year. The cost was in addition to
of Rs.1,944.50/- per household per year in zone I, Rs.1,500/- in zone II and Rs.760/- in zone III spent on preventing water pollution.

**Damage to properties**

People try to avoid living in areas polluted with tannery effluent for the fear of diseases and extra costs on water for drinking purposes. Therefore the properties in such areas had lower saleable value as compared to similar properties in unpolluted area. The loss of value of properties due to tannery pollution was large and it added to the damage costs earlier discussed.

**Damage to health of persons not related to tanneries**

Tannery pollution was instrumental in causing not only simple ailments like cold, cough and fewer, but also chronic diseases like tuberculosis, lung complaints, asthma, stomach complaints, dysentery, respiratory diseases, night blindness, skin diseases leprosy, abortion, azospermia and ologospermia. The closer to the tannery the persons lived larger was incidence of diseases among them. Those suffering prolonged illness for more than a year were 235 in number and accounted for 26.46 per cent of the total. Thus, the health loss of the resident members due to tannery pollution was not small; it was larger if they lived closer to the tanneries.

On an average a household of the study area was losing 4.3 days of work per month due to pollution inflicted diseases alone. The spatial variation in intensity of tannery pollution and the average numbers of days lost by the households in illness had a direct (positive) correlation.

On an average, they were spending Rs.101.28 (33.33%) per month on treating the diseases suffered by them. Totally it came to be Rs.607.70 per month.
The monthly average values of medical aid availed by the sample respondents from the government, tannery and other sources were Rs.452.50, 292.1 and 147.9 respectively.

The sample households were spending on an average additional expenditure of Rs.530.33 per month on the pollution related items explained above. There was not much difference among the groups in the percentage of amount spent on pollution related expenses but the significant inter-zone variations were due to varying intensity of pollution. An average household had to spend Rs.530.33 per month on pollution related expenses and it formed about 22.60 per cent of about Rs.2,246.83 of total household expense per month per household.

The impact of pollution went beyond current income to affect saving/borrowing decisions of the household and thus assumed dynamic proportions. The results showed that spatial location of household vis-à-vis the tannery determined the extent of damage suffered in the health of the people.

**Awareness and action**

Among 314 heads of the families all but 8 were not aware of the problems of pollution and the need for precautions. Paradoxically however, in spite of so much consciousness, no organized efforts had been taken to fight against this problem at their family level and socially.

A majority of 301 respondents was able to identify that common salt, live and chromium salt were the pollutants in the study area; 21 respondents did not respond to this question. Majority of the respondents from zone III of all the groups did not respond to this question. The inference was that in
these areas, the pollution impact was least felt. A majority of 122 respondents wanted both government and polluters to take co-ordinate measures. In the sample, 246, heads of families were not satisfied with the anti-pollution measures taken by both the tanneries and government; 44 were satisfied and 32 were not responding to this question. There were 259 households not satisfied with the welfare measures, if any initiated by the above three parties; 35 reported their satisfaction; no response was received from 28 households. In the sample of 322 households, only 75 households were willing to join anti-pollution movement, 190 were not willing to join anti-pollution movement, and 57 households did not respond to the question. In all 282 respondents were willing to pay additional taxes.

**Cost of abatement and damage**

The results showed that the social cost of damage by discharge of effluent should be minimized and it was possible only by increasing abatement cost. Production in 7 out of 14 tanneries was less than (but very close to) the level of production where MAC=MD and they could be considered to be within economically viable level of pollution control cost. The remaining 7 tanneries produced in excess of this level and hence their damage cost exceeded the abatement cost. They had to control pollution for the good of the society. Economics of internalizing externality was evaluated by comparing profit per tonne of the finished good for purely private cost (no externality considered) and that for social cost (the estimated damage cost fully covered). This large profit was possible due to export of leather goods to other countries. When externality was internalized all the tanneries incurred losses in the range of Rs.7.43 crores to Rs.16.72 crores per tonne, the average loss being Rs.1,531 crores. Therefore, whatever is the cause of it, total internalization of externality would discourage tannery production and reduce foreign exchange
earnings. Therefore the best option was to reduce pollution itself, through abatement activities. Through the tanneries were really in a position to meet a substantial part of the cost of abatement, they were not able to meet the entire cost. The government has to subsidize the cost of setting up ETP, because prevention (abatement) is seen to be better than the case (compensation to the damage).

**Tannery for sustainability**

It is found out in the table 5.65 that 15 per cent excise duty was levied on chrome leather per tonne and 20 per cent per tonne on chrome leather. In the case of EI leather the excise duty ranges between 1.25 and 2.83 lakhs. An average excise duty is Rs.14.31 lakhs for EI leather. So, total excise duty revenue obtained by the central government in EI leather was Rs.33.05 lakhs. Now-a-days chrome leather production in vogue and that is produced on a large scale. So excise duty obtained from it ranges between Rs.2.2140 lakhs to Rs.5.0180 lakhs. Total revenue obtained by the central government by way of excise duty was Rs.58.61 lakhs.

Therefore total excise duty amount Rs.63.564 lakhs. The duty area alone is responsible for the amount of money. But throughout Tamilnadu tanneries are the sources of largest yield of excise tax revenue. But actually tanneries produced large amount of chrome leather than EI leather of usually the tannery owners paid excise duty for EI leather saying that chrome leather was not produced. It’s leads to tax evasion. So instead of producing chrome leather is to be produced by the tannery owners. This sort of attitude of the tannery owners alone is solution for tannery externality. By this way only sustainability of tannery would be easily attained.
It is found out in the table 5.66 that 4 per cent of sales tax duty was levied on chrome leather and EI leather. In the case of EI leather the sales tax ranges between 1.25 and 2.83 lakhs. An average sales tax duty is Rs.14.31 lakhs for EI leather. So, total excise duty revenue obtained by the central government in EI leather was Rs.33.05 lakhs. Now-a-days chrome leather production in vogue and that is produced on a large scale. Sales tax obtained from it ranges between Rs.0.4428 lakhs to Rs.1.0036 lakhs. Total revenue obtained by the central government by way of excise duty was Rs.10.9824 lakhs.

Therefore total sales tax paid amount Rs.12.3044 lakhs. The duty area alone is responsible for the amount of money. But throughout Tamilnadu tanneries are the sources of largest yield of sales tax revenue. But actually tanneries produced large amount of chrome leather than EI leather of usually the tannery owners paid excise duty for EI leather saying that chrome leather was not produced. It’s leads to tax evasion. So instead of producing chrome leather is to be produced by the tannery owners. So this sort of attitude of tannery owners alone is solution for tannery externality. By this way only sustainability of tannery would be easily attained.

Fourteen tanneries in Sempet Truchirappalli City Corporation have been the sources of foreign exchange Rs.220.86 crores in the year 2005-2006. Group-I tanneries foreign exchange earned ranges between Rs.10.98 and Rs.18.85 crores. For group II tanneries it ranges between Rs.8.32 and Rs.18.80 crores. Previously the tanneries had earned more foreign exchange. During 2000 there were 30 tanneries in Sempet. Due to want of effluent treatment plant 16 tanneries have been closed year-after-year. At present there are 14 tanneries in Sempet. Since tanneries are foreign exchange earner they should be given importance. At the same time pollution of the environment should be
minimized for obtaining sustainability of tanneries. Since tanneries are existing in the society attention should be given for the welfare of the people in the society. This alone is leading to sustainability, even though they are the sources of foreign exchange earners. This is one of the merits for sustainability of tanneries.

Tanneries provide employment to large number of unskilled and semi-skilled labourers. The people living near the tanneries are of the opinion that tannery is a livelihood to large number of labourers (765) are employed in tanneries. In group-I tanneries is salary to unskilled worker was from Rs.0.35 crores to 0.57 crores. An average salary of group-I was Rs.0.47 crores. So group-I tanneries total salary was Rs.3.74 crores. In the same way group II tanneries salaries ranged between 0.32 and 0.58 crores. An average salary of group-II was Rs.0.51 crores. So, the total salary of group-II was Rs.3.08 crores. Therefore both the groups paid Rs.6.77 crores as total salary to the workers. Hence the percentage of the salary in the expenditure was substantial in the expenditure of tanneries. So it is understood that the point of provision of employment also sustainability of tannery is given importance by the surrounded people, because for poor people it is a source of livelihood.

Rs.1,743 lakhs rupees are invested in buildings, machineries and tools and equipment of the tanneries. Large number of machines, tools and equipments are needed by the tanneries. The total capital investment ranges between 117 and 131 lakhs; 125 and 131 lakhs for group-I and group-II tanneries respectively. Eventhough it is a labor intensive industry that is providing job opportunity next to agriculture. If at all tanneries are closed, it is a loss not only to the tannery owners. But also to the people who are employed in the tanneries. From this point also sustainability of tanneries is necessary.
Starting a small scale industry is a difficult task. So, tanneries are supported for their sustainability from the point of huge investment made on it.

At present common effluent treatment has been constructed with the help of central government, state government and tannery owners. Central government contribution is 9.64 per cent, state government 26.79 per cent and tannery owners contribution is 63.57 per cent. All the three bodies are benefited from tannery functioning. Among them the more beneficiaries are tanners, next state government and lost one is central government. So common effluent at present collects toxic effluent at present tanneries and treat it. Therefore common effluent treatment plant functions support the point of sustainability of tanneries.

Mere construction of common effluent plant cannot ensure sustainability of tanneries. So maintenance cost is import. In accordance with the percentage of contribution of common effluent treatment plant, maintenance cost is shared by the three bodies. Central government annual contribution must be Rs.266,064, state government contribution must be contributes Rs.739,404 and tanners contribution contribute Rs.17,54,532. So total annual maintenance cost is estimated as Rs.27,60,000. Mere construction of common effluent treatment plant cannot solve the problem of pollution. It should function properly. For that maintenance cost is essential then only it is possible for ensuring sustainability of tanneries. The tannery owners should have social welfare mindedness. This point assures long lasting of tanneries that is sustainability.
CONCLUSION

Tannery effluent production leads to pollution of the environment. The externality caused by the tanneries should be minimized by internalizing it. But tanneries cannot bear total damage cost, so central government, state government and tannery owners have been responsible for abating pollution. Pollution abatement automatically leads to sustainability of tanneries. Sustainability of tannery leads to intertemporal distribution of wealth, income and employment, at this stage only society welfare is maximized.

Policy implications

Above summary and conclusions have to a few implications for the government policies. They are stated below: pollution by tanneries must be checked and damages already suffered must be compensated / corrected, but this can be done only by the collective efforts of the government tanneries and the persons affected. Therefore, it is desirable to have a planning cell in the pollution control board with experts in the subjects concerned to formulate location specific plans and to monitor their implementation.

The persons affected by pollution are aware of the damage; but suffer the damages silently for want of an organization to help them. The persons may be motivated and assisted to develop suitable institution to help them. The process of educating the public and motivating them for collective action must be the responsibility of the pollution control board and district authorities.

Abatement is better than management of damage. The common effluent treatment plants are cost effective methods of pollution control. Establishing such plants at suitable locations must be planned and their costs are subsidized by the government.
It is necessary to promote research on methods of skin and hides tanning that are less polluting and cost effective in pollution control. This responsibility must be shared by the tanneries and the government.

The government must discourage by legislative and administrative measure, the employment of temporary workers in the tanneries. The permanent workers must be entitled to total protection against occupational hazards to their health. It requires supply of protective gloves and face masks and training to the workers on safe method of handling the process. Public health facilities should be enlarged and be made available either free of cost or at low costs.

In the present study indicates that tanneries discharged large quantity of effluent into the environment. So, environmental awareness should be created in the minds of the people in surrounded area.

Since tanneries are foreign exchange earners, it should be given importance by constructing common effluent treatment plant. So state and central government bear 36 per cent of the expenditure of common effluent treatment plant. This would result in sustainability of tanneries. At present common effluent treatment plant is functioning in this study area.

Since all the tanneries are earning profit, it is also possible on the part, on the part of the tannery owners to construct individual treatment plant, because it is within the reach of the tannery owners. They should have moral and social responsibility to control pollution. Because tannery is existing within the society or part of the society.
The pollution control board should supervise periodically whether the common effluent and individual effluent treatment plants are functioning properly. Then only the tanneries are productive and profitable in nature.

Environment protection alone can speed up economic development. So environmental degradation caused by tannery pollution should be controlled by all means even though it is a foreign exchange earner.

Equal distribution of income and wealth enables the society to have a well protected environment, so it is a sort of incentive for having reasonable standard of living and eradication of poverty.

Tannery owners should have in their mind to protect the welfare of the people. That would lead to sustainable development of tannery rather than closure of tanneries.

Treated effluent of tanneries should be used for horticultural and gardening purposes.
Inputs chemicals / water

- **Soaking**
  - Water bactericide enzyme

- **Liming Unhairing**
  - Water lime sodium Sulphide enzyme

- **Fleshing**
  - Water

- **Washing**
  - Water

- **Deliming / batting**
  - Water (Ammonium salts bating enzymes)

- **Washing**
  - Water

- **Decreasing / washing**
  - Water, solvent, degreasing agents surfactants

- **Pickling**
  - Water, salt Sulphuric acid
Chrome tanning

Neutralization and washing (Drums)

Retaining / dyeing / fat liquoring (Drums)

Finishing (Autospray)

Washing (Drums)

Rechroming (Drums)

Water, BCS /Chrome syntan, sodium formate, sodium bicarbonate

Water, neutralizing syntan / sodium formate, sodium bicarbonate

Water, syntans dyes and fat liquors

Water,Chrome syntan, sodium formate, sodium bicarbonate

Water, Acetic acid, wetting agent

Water, basic chromium, sulphate, sodium formate and sodium bicarbonate

Water, solvents, pigments, binders, wax and liquor emulsion
Finished leather

Solid waste

Raw hide trimmings 80 to 120 kg
dusted salt: 50 to 80 kg

Wet blue unusable splits 100 to 110 kg

Wet blue shavings and trimmings 90 to 100 kg

Crust trimming 6 to 8 kg

Buffing dust – 1-2kg

Rechroming

Hair / Wool 40 to 50 kg

Fleshing 250 to 300 kg

Trimming, sorting desalting (raw material storage yard)

Soaking

Liming Unhairing

Fleshing

Chrome tanning

Pickling

Deliming / batting

Washing

Wet blue

Splitting (splitting machine)

Washing (drums)

Wet blue

Shaving (shaving machine)

Washing (drums)

Drying / staking / trimming

Retaining dyeing / fat liquoring (drums)

Neutralization and washing (Drums)

Rechroming (Drums)

Finishing (Autospray)

73. Leather processing and sources of waste