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## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

On request of the Netherlands Minister for Development Cooperation the Commission for Environmental Impact Assessment (EIA)<sup>1]</sup> advises in this document on the appraisal of the studies 'Introduction of cleaner technologies in tannery clusters of Punjab<sup>2]</sup> and 'Techno-economic study of combined effluent treatment plants for tannery clusters in Punjab<sup>3]</sup> and the project proposals as formulated therein. In this advice correspondence and other documents on the project proposals have been taken into account.

In addition to the appraisal of the studies the Commission formulates remarks with regard to the problem analysis, the objectives of the proposed projects and the approach for environmental management as formulated by the Pakistan Tanners Association (PTA).

With regard to the problem analysis, it is observed that in the forementioned studies the analysis of the origin and causes of the rapid development of the Pakistan leather industry and the environmental problems occurring as consequence of this development, are not fully complete. According to the Commission, the causes of the rapid development of the leather industry in recent times are the local availability of hides and cheap labour, combined with low investment levels and limited attention for environmental problems.

The studies conclude that export markets are increasingly imposing environmental requirements on production processes. In the studies an analysis is made of the main environmental stress factors. Technical in-house and end-of-pipe solutions are proposed and an approach to implement the findings of the studies, is formulated in the form of project proposals.

The Commission appraises the results of the analysis in the studies and proposes to develop a priority listing of environmental measures on the hand of their cost-effectiveness, practicality and fitness for rapid introduction. Moreover the Commissions thinks that end-of-pipe technologies should be developed complementary to and tuned to in-house arrangements and that they should be embedded in city development plans.

The studies present a list of institutions that will be involved in the implementation of the proposed projects. The Commission stresses the importance of law enforcement and of the development of an adequate institutional structure for cost recovery of central facilities. Moreover the Commission, from the documents, is unable to get a clear understanding of the mandate of the PTA and by which part of the tanneries this mandate has been given.

The Commission comes to the following conclusions regarding the Introduction study and the CETP study and the project proposals as formulated therein.

- ! The PTA studies presently performed a comprehensive but general overview of the actual situation in a number of clusters of Punjab tanneries and give general approaches to improve the environmental situation.
- ! Due to this general character and the absence of the past and perspectives of the leather sector, the assessments of investments in manpower and material do not seem to be a sufficiently accurate basis for the introduction of well sustainable cost-effective measures.
- ! The technical in-tannery and end-of-pipe measures selected in the studies are not in all cases up-to-date and they may be more adequately prioritized. They are presented as two different separate actions. The necessary interactions have not been taken into account. This prevents the realisation of optimum cost-effective solutions.

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1 Further referenced as 'the Commission'.

2 Further referenced as 'Introduction study'.

3 Further referenced as 'CETP study' in which CETP stands for Combined Effluent Treatment Plant.

- ! The Commission misses embedding of the measures proposed in city development plans. They do not seem to take into consideration the communal socioeconomic aspects; this seems to hamper local involvement that is essential for implementation of sustainable environmental technology.
- ! According to the Commission the required institutional infrastructure to support the target development and the allocation of responsibilities, has not been sufficiently described in the documents. The Commission misses assessment of the capacities to implement these measures.
- ! From the documents the function and mandate of PTA cannot be fully known. It is not clear which mandate has been given by which part of the tanneries.
- ! The PTA documents seem to address the large and medium sized tanneries only because small tanneries are said to be no viable option. The Commission misses information that underpins this statement and an assessment of its consequences.

With regard to the project proposals as formulated in the Introduction study and the CETP study the Commission has the opinion that they cover a great deal of the environmental problems involved. The Commission thinks, however, that cost-effective solutions require to be implemented on concrete locations where the essential integration of in-tannery and end-of-pipe measures can be realised. For this reason a viable programme should comprise:

- ! The execution of inventories and actions on the local technical and economical situation in the tanneries and the practical introduction of tailor- made in-tannery measures.
- ! The execution of inventories and actions to define the CETP-options based on introduced in-tannery measures, including possibilities for central production units and facilities available on a hired basis by small scale tanners.
- ! The execution of inventories and actions on the socioeconomic consequences of possible environmental measures covering the longer term industrial and communal aspects and the embedding of measures in the local communal/city planning. Such a study should lead to the local optimum of central facilities, its logistics and cost recovery measures.
- ! The actual realization and operation of the optimum central facilities.

- ! The evaluation of the cost-effectiveness of the measures as an example for the remedial treatment of the environmental problems of the leather industry on other locations.
- ! Effective enforcement of environmental legislation. To attain this, it is recommended to involve enforcement agencies in programme execution.

The definition of a programme for specific locations can be based on information collected in the context of an environmental impact assessment procedure. In this procedure alternative programmes, to be defined prior to and possibly during the scoping phase, can be compared on environmental, institutional and social impacts and on their economic viability.

In EISs that may be made for development plans for the tannery sector in specific locations, the recommendations given above and the Kasur advice may form the basis for the definition of an alternative, in which the perspectives of all categories of tanneries are studied, in which in-tannery measures, central facilities and end-of pipe technology are developed as a set of complementary measures for environmental management and in which specifications for CETPs are defined on the basis of communal/city planning.



## 1. INTRODUCTION

In a reaction on the advice of the Commission for EIA on review of the Environmental Impact Statement for the Kasur Tanneries Effluent Treatment Plant<sup>4]</sup> and in the framework of a Clean Technology Programme for Tannery Clusters in Pakistan, the Royal Netherlands Embassy (RNE) in Islamabad and the Pakistan Tanners Association (PTA) agreed to commission two studies. The first study concerned the introduction of cleaner technologies in the tanneries in Punjab. The second study related to the technical and economic aspects of combined effluent treatment plants in the tannery clusters in Punjab. Both studies, recently handed over to the RNE, formulate proposals for projects submitted to the Directorate-General for International Cooperation (DGIS) for funding. In the process of appraisal of these studies and preparation of a project proposal related to these studies, correspondence developed between PTA, the Netherlands Embassy in Islamabad and the Directorate General for International Cooperation in the Netherlands.

Subsequently the consultant Haskoning submitted a proposal to the DGIS for a comprehensive study of the tannery clusters in Sialkot and Multan. This study, ordered by PTA and meant to culminate in a development strategy for the tannery sector in these cities, is submitted for funding in the framework of the MILIEV<sup>5]</sup> programme.

In his letter of 16 November 1995 (see appendix 1), the Minister for International Cooperation requested the Commission for Environmental Impact Assessment to formulate an advice on review of the existing information and initiatives. Also, the Minister would like to receive recommendations-/specifications for follow up activities in the process of appraisal and formulation of the project proposals presented in the studies, including the potential application of Environmental Impact Assessment (EIA) to the decision making for such follow up activities.

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4 Advice published on 13 January 1994.

5 The MILIEV programme is established to co-finance initiatives that have a direct beneficial effect on the environment. Only Dutch commercial enterprises may apply for contributions of the MILIEV programme.

## 2. JUSTIFICATION OF THE APPROACH

The referred request for advice is not the regular type of request the Commission for EIA responds to. It does not, in a direct sense, concern formulation of an advice on guidelines for, or review of an Environmental Impact Statement (EIS). The Commission however, would like to respond to the request, viewing this advice as an onset to advices for guidelines for EIAs on the locations of tannery clusters.

The request for advice indicated a short advising term. This term could not be realized because up to date information from Islamabad was needed to formulate meaningful recommendations. The Commission did not consider a site visit to be functional in this stage of project preparation. In order to formulate this advice a working group was formed, combining the following disciplines: Sociology, Economy, Institutional development, Leather Technology, Environmental aspects of Leather Processing and Toxicology.

The present advice, in chapter 3, summarizes the problems of the Punjab tannery sector as stated and analysed by PTA. The project objectives and the project approach – as formulated by PTA – are summarized as well. Subsequently observations are made with regard to this problem analysis, these project objectives and the project approach of PTA. Recommendations are formulated in chapter 4.

This advice is formulated in line with the philosophy of the Kasur advice.

## 3. PROBLEM ANALYSIS, PROJECT OBJECTIVES AND APPROACH

### 3.1 The PTA-documents

#### 3.1.1 Problem and problem analysis

A general problem definition is given in the executive summary of the Introduction study on page ii: *"The leather industry is one of the oldest industries in Pakistan. The tanning industry is known for the generation of enormous amounts of obnoxious wastes, mainly due to the use of conventional processing practices."* Chapter 3 of this study presents a number of problems related to different unit operations actually applied in the leather industry.

The CETP study does not explicitly state problems in a specific chapter. The problems found in the various paragraphs of the study must thus be seen as part of the problem to be solved.

#### 3.1.2 Project objectives

In the Introduction study it is stated that the study *"should bring to light the concept of introducing improved environmental practices and cleaner technologies..., thereby avoiding waste generation and minimizing the use of raw materials."*

In the CETP study project objectives are described as:

- ! *"documenting and analysing the existing status of tannery clusters in Punjab"* with regard to the *"physical setting in each city, drainage system and service levels, climatic conditions and characteristics of effluents"*,
- ! *"to select those tannery clusters where CETPs could be installed"*,
- ! *"to select on the basis of the inventories and literature studies the best practicable end-of-pipe treatment technologies and in-tannery measures"*.

#### 3.1.3 Approach

An important guideline in the PTA approach has been the project document recommending a menu of environmental actions to be implemented under the PTA Environmental Management Programme in Korangi-Karachi.

The proposed menu is as followed:

- i) In-house Environmental Improvement Programme.
- ii) Techno-economic Study for Combined Effluent Treatment Plant.
- iii) Installation of Chrome Recovery Plants in the individual tanneries.
- iv) Installation of Combined Effluent Treatment Plant.
- v) Collection of Effluent (drainage system).
- vi) Solid Waste Management Programme.
- vii) Environmental Impact Assessment.
- viii) Occupational Health & Safety Programme.
- ix) Institutional Strengthening of PTA.
- x) Industrial Extension Programme.

The studies discussed in this advice relate to the points i and ii of this menu.

In these studies the situation in the Punjab leather sector is assessed by:

- ! Field inventories in three tanneries (one small-, one medium- and one large sized) in each of the clusters. Based on this information an indication is given of in-house measures to be implemented in Punjab tanneries.
- ! A more detailed analysis of five clusters with regard to the possibilities to establish CETPs. This analysis led to the indication of two preferred location for CETPs: Sialkot, Sambrial-Wazirabad road cluster and Sheikhpura, Lahore-Sheikhpura road cluster.
- ! Assessments, based on analyses of local situations, of the level of necessary investments in selected end-of-pipe and in-tannery measures. Moreover staff training requirements have been assessed.

#### 3.1.4

#### **Institutional aspects**

In the project documents the various institutions and organizations that will be involved in the implementation of the programmes are mentioned. These are:

- ! Government Agencies (Industry Department, Public Health Engineering Department.
- ! City Development authorities, Local Bodies, EPA-Punjab, LIDO, ILT-Gujranwala, NILT, LPDCs CSC Kasur, and Small Leather Training Centres of PSCC).
- ! PTA, PTA-Northern Zone, and Tanners Local Associations.
- ! Extension Programme Team (for cleaner technologies).
- ! Individual Tanners.

In the Punjab government, Public Health Engineering Department, Industry Department, Housing & Physical Planning Department, and EPA-Punjab are the most relevant departments. City Development Authorities, local bodies, and district administration are the second tier of city level project implementation agencies.

At federal level, Leather Industry Development Organization (LIDO) under the Ministry of Commerce is directly responsible for issues in the leather sector. LIDO has its presence at the local level through Institute of Leather Technology (ILT) Gujranwala, CSC Kasur, LPDCs, and National Institute of Leather Technology, and Small Leather Training Centre of PSCC.

For the implementation of the Cleaner technology programme it is stated that:

All the medium and large industries are supposed to get No Objection Certificate from the Department of Industries. EPA-Punjab is also in the process of acquiring these powers. The Industry



Department, in coordination with EPA-Punjab, should ensure that all the recommendations and measures have been adopted by the new tanneries. For the existing tanneries EPA-Punjab, in coordination with PTA-Northern Zone, Tanners Local Associations and Extension Programme Team, should make arrangements for the implementation of In-house Improvement Programme.

## 3.2 Remarks<sup>6]</sup>

### 3.2.1 **General remarks on the problem analysis and PTA approach**

The proposed project packages related to cleaner technologies and CETPs may provide an important contribution to pollution prevention and control in the tannery sector in Punjab. However, based on earlier experiences in this field, important success and failure factors for such a programme include:

- a. full political willingness to implement industrial pollution control programmes and commitment to support the programme for tanneries;
- b. financial affordability of the proposed measures for the tanners;
- c. effective enforcement of environmental and occupational health and safety (OHS) legislation.

ad a) It is understood that the Pakistan Environmental Protection Act 1995 is under consideration by the parliament and not implemented yet. The proposed programme for tanneries (the Introduction study and CETP study) is focused on large and medium scale industries, anticipating the non-viability of small tanneries. Full political support for such a strategy seems to be weak as a large part of the tannery sector concerns small scale industries.

ad b) The studies did not elaborate on the affordability of the proposed measures. No profile of economical performance of the various tanneries is available. To have at least an indication of probable success of the programme, one should estimate to which extent the profit margins are to be affected by in-house measures (this is expected to be very small for the target groups) and by end-of-pipe treatment (this is expected to have a larger impact). To recover O&M costs of CETPs from the individual tanners an effective institutional and levy/fee system is a prerequisite.

ad c) If enforcement of environmental and OHS legislation is weak and compliance with regulations is not taking place, there will be no support from the tanners' side to contribute to CETPs as 'dead investments'.

Commitment of EPA and labour inspectorates to strictly enforce the regulations is a precondition. This should refer to the tannery sector as a whole, which as such is a difficult issue considering the situation in the small scale tanneries.

The above mentioned elements (a – c) constitute only a small part of the success and failure factors. Other factors include the reluctance to accept change in this traditional sector industry and more important the socioeconomic consequences in case the setup of CETPs in leather complexes is part of a relocation programme of tanneries.

### 3.2.2 **Analysis of the origin of the problems**

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6 An appraisal of the studies can be found in appendix 3.

In the definition of the problem one of the most relevant issues is missing: the development of the leather sector in the past and the expectations for the future. A recent study in India<sup>7]</sup> reveals the following important aspects:

The key problem of the leather industry in many developing countries is its booming development. In most cases the leather sector started in the past decades with hide collection and hide export and, on a small scale, vegetable leather processing for the local market. The temporarily low investment level combined with the limited attention for environmental problems makes the leather sector in development countries very competitive. The local availability of hide material and especially of cheap labour with the preparedness to do dirty work under unfavourable health circumstances, gives this sector the first impulse to develop in a hardly controlled way to a large scale industry. This leads in many developing countries to a booming leather business, which envisages the import of hide material from abroad and the application of new technologies like chrome tanning, in order to comply with the quality requirements of the foreign markets. Continuation of operating in the conventional way leads to booming environmental problems which are no longer acceptable to the local community and which are increasingly disputed by the foreign markets.

A thorough description of the problem should thus include the past and the perspectives of the activity in the Punjab leather industry in general and in each cluster in particular.

### 3.2.3

#### **Analysis of the type and extent of environmental problems**

Section 3 of the Introduction study presents an overview of the environmental problems in relation to different unit operations. Alternatives are presented in this section as well. A short list of the most relevant avoidable and inevitable concrete environmental problems however, is missing. Environmental problems may be summarized as:

Odour nuisance as a result of:

- ! Development of hydrogen sulphide as a result of undisciplined/indiscriminate use of sulphide, main component in nearly all practicable dehairing substances. The gas also develops in drains and sewers as a result of emissions of sulphates and subsequent anaerobic reactions with biologically degradable matter of industrial and domestic origin.
- ! Undisciplined and excessive use of certain biocides as conserving agents.
- ! Odour of putrefaction and increased development of vermin populations as a result of inadequate disposal of hide fragments and solid wastes.
- ! Emissions of noxious vapours due to undisciplined/inefficient use of organic solvents in the degreasing and in the finishing process in absence of adequate air treatment technology.

Water pollution as a result of:

- ! practically unavoidable and untreatable emissions of sodium chloride originating from curing salts;
- ! avoidable, treatable emissions of chrome and sulphate;
- ! unavoidable, treatable emissions of biologically degradable organic material.

Soil pollution particularly originating from:

- ! emissions of salts: chlorides, sulphates and sulphides.

Solid wastes:

- ! chrome containing sludges, trimmings and shavings;
- ! chrome-free organic wastes.

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7 TNO-CLRI programme, see appendix 4.

Especially the detrimental effects of the emission of chloride and sulphate should be given more emphasis:

Recent investigations in the framework of the 'Institutional Strengthening Programme for the Indian leather sector in the field of environmental technology', (appendix 4) revealed that the conversion to chrome tanning and the related increase of sulphate emission has specific consequences with regard to the transport and treatment of waste water. The well known anaerobic conversion of sulphate to sulphide, causes toxification of the digestion process in anaerobic reactors and the production of sulphide in sewers and canals.

Moreover, the presence of sulphur compounds in open semi anaerobic canals and sewer systems causes bad biodegradation and longlasting stench problems due to "never ending sulphur cycles". In such cycles the anaerobic formation of sulphide and carbon dioxide is found to be reversed under influence of sunlight by means of the bacteria *Chromatium sp.* This photosynthesis leads to the production of biomass and sulphur to be digested again to sulphide and carbon dioxide.

For this reason the problem of odour nuisance, toxicity and corrosivity of hydrogen sulphide caused by chrome tanning, makes specific in-tannery and end-of-pipe technologies necessary to drastically remove sulphur compounds.

#### 3.2.4

#### **Remarks on the PTA objectives and the PTA approach**

Although it is not clear to which extent the approximately 20 clusters mentioned are represented, it is expected that the inventory given in the Introduction study represents a useful general overview. However, it seems impossible to determine on the general basis as described in the study the most suitable and cost-effective measures which are applicable in the situations covered. The introduction of in-tannery and end-of-pipe technologies are presented too much as separate activities. Interactions with other existing or planned local sanitary facilities like communal waste water and sewer systems, are not taken into account.

The 'Institutional Strengthening Programme for the Indian leather sector in the field of environmental technology' has learned that cost-effective measures are combinations of selected in-tannery and end-of-pipe technologies, which are strongly determined by the local situation in the tanneries and the community.

In view of the very general approach of the studies, the different budgets mentioned in the proposals are considered to be rather speculative assessments of measures, which are not expected to be highly cost-effective.

With regard to the technical alternatives discussed in chapter 3 of the Introduction study the following observations can be made:

In a general sense priority should be given to technical alternatives with high cost-effectiveness and easy practicality, which can be introduced at short notice. This leads to the following remarks with regard to priorities:

- ! Alternatives for salt curing must score a low priority: in most cases salt-curing is not an activity of leather industry and with increasingly open hide markets it is a mondial problem that will not be solved in a foreseeable future. Concentration of the salt emission by dry-milling and segregation of soak liquors in combination with the search of locally accessible and acceptable outlets of chloride emissions should thus be given high priority.
- ! Alternatives to unhairing score a low priority: with respect to the integral environmental consequences, there is hardly a versatile alternative to destructive sulphide unhairing.
- ! Deliming: introduction of the sophisticated CO<sub>2</sub>-deliming scores a medium priority; the application of biodegradable acid deliming agents scores a high priority because of its easy practicality in large, medium as well as small scale tanneries.

- ! Degreasing: the sophisticated application of organic solvents seems to score a lower priority than the easier to perform application of emulgators.
- ! Pickling: one of the most tough environmental problems caused by pickling is the application and emission of chloride. The application of biodegradable pickling agents and especially the reuse of spent chrome tanning liquors as pickling solvent consequently score a high priority.
- ! Chrome tanning: in view of the environmental problems of the emission of sulphates chrome recovery by means of precipitation and redissolution of the recovered chrome in sulphuric acid is no longer the most environmentally friendly option. For this reason this scores a low priority. Newly studied (appendix 4), easy to perform high exhaustion chrome tanning technologies offer the possibility of complete reuse of the spent tanning liquor as pickle solvent. This enables complete chrome uptake and nil chrome and sulphate emission via the spent chrome tanning liquor. Introduction of this technology is easy to perform without additional investments by all type of tanneries and thus scores a high priority.
- ! In the CETP study two clusters are indicated to be suited for the realization of CETP's. The selection of these clusters is based on a list of very relevant criteria. However, not much attention is given to matching of such a CETP with the local sanitary setup or its planning and the socioeconomic aspects of the community. Moreover, the selection is strongly directed to the medium and large scale industry without the involvement of the small scale tanneries. In view of the high environmental and socioeconomic significance of this small scale sector it seems relevant to consider options of centralized production units for the most polluting phases of the leather making process.  
In such a setup, arrangements could be made to make facilities available on a hired basis for small scale tanners. This really opens the way to an integral cleaning up of the tannery sector in a region or city.
- ! The CETP study gives the impression that the selected end-of-pipe technology solves the environmental problem of the leather industry in its actual performance against a price to be calculated. However, the real cost- effectiveness is greatly determined by the composition and quantity of waste water to deal with and fitting in, of the CETP in the water management of the local community. With regard to the composition and quantity of the waste water the actual situation cannot be considered as a reliable source of information. Prior to the selection and description of a cost-effective CETP an assessment of the local applicable in-tannery measures and their consequences on the quality and quantity of waste water should be given. Evidently in the same way also the perspectives of the local leather sector should be included.
- ! With regard to the selection of end-of-pipe technology one should be very keen on the financial sustainability. In the CETP study the financially attractive UASB-technology has been ruled out for reasons which have become recently outdated.

In the framework of the Institutional Strengthening Programme (appendix 4) the successful applicability of the UASB concept for tannery waste water without the admixture of domestic sewage has been proven. The additional benefits of this technology comprise the generation of biogas to feed the aerator engines of the post treatment system and the practically complete conversion of the sulphur compounds followed by their removal as elemental sulphur.

### 3.2.5

#### **Remarks on the institutional setup**

The documents indicate PTA to be the representative body of the tanners. From the documents it is not clear which proportion of the tanners the PTA really represents, nor the distribution of its members over the various sizes of tanneries. Given the fact that PTA proposals seem to be directed towards the medium and large scale industries the Commission questions the – effective – adherence of large numbers of small scale tanners.

An integrated programme for Cleaner technologies and CETPs requires an integrated institutional setup with clear roles of the various institutions. The need for Institutional Strengthening of local

tanneries associations is evident. Considering the important role of-EPA Punjab in enforcement, the need for an institutional strengthening programme for EPA-Punjab (including training) should be analyzed.

An important aspect is the institutional/organisational elaboration for recovery of CETPs' operation and maintenance costs. Training in operation and maintenance of CETPs should also be considered as an essential element in the programme.

### 3.2.6

#### **Objectives, approach and social aspects**

The PTA approach seems to be targeted to the medium and larger categories of tanneries. There are no indications that the future of the small scale enterprises is the concern of the PTA. In the Introduction study it is concluded that 'leather processing by its nature and characteristics, is not the activity for small scale processing'. This suggests that PTA has the opinion that these tanneries must stop their activities. The social and economic consequences of this standpoint do not seem to have been subject of further study. Moreover, it may not be realistic to assume that the smaller tanneries will effectively stop their activities. Although no in-depth study of the sector in Punjab is available, one may expect that, if indeed as stated, the smaller tanneries mainly use low quality raw material and serve the internal market, pressure on these tanneries to clean their production processes or to close down will be less effective as compared to the tanneries that serve the export market on the basis of processed high quality (imported) hides.

The fact that the proposed PTA-programmes mainly address the medium and large scale tanneries may thus result in a situation that the smaller tanneries will continue to function as they do and a substantial part of the environmental stress will continue to occur.

### 3.3

### Conclusions

These conclusions regard the Introduction study and the CETP study and the project proposals as formulated therein.

- ! The PTA studies presently performed a comprehensive but general overview of the actual situation in a number of clusters of Punjab tanneries and give general approaches to improve the environmental situation.
- ! Due to this general character and the absence of the past and perspectives of the leather sector, the assessments of investments in manpower and material do not seem to be a sufficiently accurate basis for the introduction of well sustainable cost-effective measures.
- ! The technical in-tannery and end-of-pipe measures selected in the studies are not in all cases up-to-date and they may be more adequately prioritized. They are presented as two different separate actions. The necessary interactions have not been taken into account. This prevents the realisation of optimum cost-effective solutions.
- ! The Commission misses embedding of the measures proposed in city development plans. They do not seem to take into consideration the communal socioeconomic aspects; this seems to hamper local involvement that is essential for implementation of sustainable environmental technology.
- ! According to the Commission the required institutional infrastructure to support the target development and the allocation of responsibilities has not been sufficiently described in the documents. The Commission misses assessment of the capacities to implement these measures.
- ! From the documents the function and mandate of PTA cannot be fully known. It is not clear which mandate has been given by which part of the tanneries.
- ! The PTA documents seem to address the large and medium sized tanneries only because small tanneries are said to be no viable option. The Commission misses information that underpins this statement and the assessment of its consequences.

#### 4. RECOMMENDATIONS

These recommendations relate to the project proposals as formulated in the Introduction study and the CETP study. The proposals cover a great deal of the environmental problems involved. However, cost-effective solutions require to be implemented on concrete locations where the essential integration of in-tannery and end-of-pipe measures can be realised. For this reason a viable programme should comprise:

- ! The execution of inventories and actions on the local technical and economical situation in the tanneries and the practical introduction of tailor made in-tannery measures.
- ! The execution of inventories and actions to define the CETP-options based on introduced in-tannery measures, including possibilities for central production units and facilities available on a hired basis by small scale tanners.
- ! The execution of inventories and actions on the socioeconomic consequences of possible environmental measures covering the longer term industrial and communal aspects and the embedding of the measures in the local communal/city planning. Such a study should lead to the local optimum of central facilities, its logistics and cost recovery measures.
- ! The actual realization and operation of the optimum central facilities.
- ! The evaluation of the cost-effectiveness of the measures as an example for the remedial treatment of the environmental problems of the leather industry on other locations.
- ! Effective enforcement of environmental legislation. To attain this it is recommended to involve enforcement agencies in programme execution.

The definition of a programme for specific locations can be based on information collected in the context of an environmental impact assessment procedure. In this procedure alternative programmes, to be defined prior to, and possibly during the scoping phase, can be compared on environmental, institutional and social impacts and on their economic viability.

In EISs that may be made for development plans for the tannery sector in specific locations the recommendations given above and the Kasur advice may form the basis for the definition of an alternative, in which perspectives of all categories of tanneries are studied, in which in-tannery measures, central facilities and end-of-pipe technology are developed as a set of complementary measures for environmental management and in which specifications for CETPs are defined on the basis of communal/city planning.