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Third quarterly report and final report within counterpart subcontract no. 97/219: Support to the National Cleaner Production Centre, Tanzania

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1999

Annexes (in separate report):

Background papers from the evaluation of CEPITA companies:

1. Tanga Cement Company
2. GALCO
3. AGACO
4. Lake Soap Industries
5. Bonite Bottlers
6. Voil

2. Summary of barriers and incentives to cleaner production in Tanzania based on the experiences from the first centre demonstration projects and the long-term experiences with cleaner production in the CEPITA-companies

This paragraph summarises the experience with cleaner production from the CEPITA-companies (companies that took part in a DANIDA-financed cleaner production project 1994-95) and from the companies that took part in the first CPCT cleaner production demonstration project 1996-97. A typology for the discussion of barriers and incentives is to focus on

- the pressure on the companies from public regulation
- the ability of the company to work with cleaner production
- the frames that could support cleaner production as strategy.

2.1 Experience with cleaner production from the CEPITA-companies

The objective of the evaluation of the experience with cleaner production in the CEPITA-companies was to analyse experience with long-term implementation of cleaner production in Tanzanian companies.
The analyses should contribute with knowledge about the dynamics of preventive environmental strategies in companies in order to contribute to the development of theories on the dynamics of company environmental performance and the strategic planning of research and public regulation initiatives in a Tanzanian context.
The evaluation was carried out as an ex-ante evaluation, based on

- interviews with management and employees in the companies

- walk-through at the facilities of the companies

- going through documents about the company.

The implementation of cleaner production in the companies is analysed in interaction with the technological, organisational and economic development in the company and in the relevant branches and the changes in public regulation. The full description of the evaluation methodology and the work plan was described in the First quarterly report within this subcontract. Eight companies were analysed during the evaluation.

The status for the implementation can be summarised like this, using the typology used in the evaluation of the cleaner production activities in DESIRE project in India focusing on the practical value, the technical value and the systemic value.

The practical value is assessed as

- the part of the generated options that have been implemented
- the economic benefit to the company in terms of payback time
- the environmental improvement obtained.

The companies have all implemented at least 25% of the generated options. That is, some implementation of cleaner production has taken place in all analysed companies. Six of the

companies have mainly implemented options that were not very capital demanding. That is, the focus has mainly been on good housekeeping in these companies. In two companies (Kioo (glass bottle manufacturer) and Tanga Cement Company) the focus has been on as well changes in working routines as capital demanding options. Kioo, a private Indian owned company, invested in a whole new production line, where cleaner production was one of the design criteria. According to the cleaner production trainee, the possibilities for savings through minimisation of waste streams was together with the big problems the company had with the product quality the background for the decision. In Tanga Cement Company a joint venture with a foreign company gave the economic basis for a refurbishment of the plant. In this process the trainee was able to get a number of capital demanding cleaner production options implemented.

The technical value is assessed as high if the implemented options can be characterised as innovations within the branch. If the implemented options primarily are well-known possibilities for environmental improvement the technical value is low. For Kioo, the new production line must be characterised as an environmental innovation. The same goes for a few of the changes made at the cement plant. However, for most of the options at the cement plant and for the six other companies the cleaner production options are environmental improvements.

The systemic value is assessed as the extent to which procedures that seem to support the continuation of cleaner production has been implemented. That could be: environmental policy or strategy, production management, employee involvement, materials accounting and cleaner production assessment carried out as part of investments and changes since the end of the project. In several of the companies the systemic value is significant, due to employee and supervisor involvement in the implementation of cleaner production and due to some kind of material accounting and/or production management. In two of the companies the commitment of the trainee to cleaner production has led to the development and implementation of new cleaner production options.

The incentives and the barriers to cleaner production are summarised in the following paragraph with respect to

- the role of public regulation and demands from the network of the company,
- the ability of the company to work with cleaner production,
- frames that can enable the company to implement cleaner production.

In general the public environmental regulation does not seem to have had influence on the implementation of cleaner production in the companies. However, a textile company felt a pressure to environmental improvement due to the visit of the vice-president. This kind of personal pressure has been used in several regions in Tanzania to make companies minimise their pollution of the local and regional environment. Moreover it has created fear for sanctions in other companies. The textile company applied for a loan from an international bank for the investment in a waste water treatment facility. The bank demanded that cleaner production should be considered as part of the planning of the facility. The local authorities did not follow up on this. Only due to the CEPITA consultant became cleaner production part with of the treatment facility project. This has not, however, yet had any practical implications. For the textile company, demand from a customer to the kind of dye stuff used forced the company to substitute some of their chemicals to less polluting chemicals, although the demand of the customer was related to the health risk to the consumer wearing the textiles. The bottle manufacturing company decided to build a new production line,

because it lost a big contract due to poor quality of the bottles and because the trainee pointed to the possibilities for economic savings via less waste and less resource consumption at a new line.

In all eight companies the commitment of the trainee has been important for the implementation of cleaner production. However, in all companies the commitment to cleaner production is still dependent on the trainee. This means that the implementation of cleaner production might stop, if the trainee is fired or moves to another plant. This has been the case in two companies. In a beverage company, where a lot of cleaner production options were implemented during and right after the CEPITA project, no more options has been implemented since, due to the trainee's big interest and commitment to quality assurance. The overall development and policy of the company is also very important for the implementation of cleaner production. In two companies the management seem to be committed in general to environmental care. In two companies that are part of or affiliated to transnational corporations, the environmental policy of the corporation has been a prerequisite to the local management's accept of cleaner production.

In two companies co-operation with suppliers has been part of either the analysis of the cause to an environmental problem or the prevention of the problem:

- the cement company has demanded better quality of the cement bags in order to minimise the number of bag breaks,
- in order to minimise waste during unloading, the cement company has asked suppliers to be more careful when unloading oil and the beverage company has asked suppliers to be more careful when unloading oil and raw materials.

The cement company would like to add 5% flying ash to the cement in order to save natural resources. In order to make this possible, a change in the quality standards or norms for cement is necessary. A company producing edible oil, which is very committed to environmental care see the lack of quality criteria for edible oil as a barrier to their future development, since they have to face a strong price competition from local produced oil and from imported oil of a poor quality.

As annex to this report are background papers from the evaluation of six of the companies.

2.2 Experience with cleaner production from the CPCT demonstration project companies

The experience from the demonstration project in Dar es Salaam and in Zanzibar was described in details in the Second quarterly report within this subcontract. The experience is summarised in the following paragraphs.

- complaints from people in the surrounding area was part of the background for the commitment of a number of companies to take part in the project
- due to the integration of occupational health and safety in the cleaner production manual being used in the project, occupational health and safety has been part of the focus in several companies,
- in some companies the trainee has been too weak to get the necessary commitment from the management to take part in the project, although the management was positive when contacted by CPCT. In one company the trainee went on further education in another country and was not

replaced. Retrenchment in one company has had a big negative influence for the work of the cleaner production team,

- the commitment of the trainees are very essential for the implementation of cleaner production. This commitment has in three companies been based on a clear stated care for the environment and in one company also on care for workers' health. The possibilities for economic savings were also important for the trainee commitment in the two of the companies,
- the environmental impact and the resource and capital loss from breaks and leaks are significant due to the long time it takes to import spare parts, due to the need for pre-payment, slow transfer of foreign currency and the bureaucratic procedures in especially parastatal companies concerning decisions like purchase of spare parts from other countries.

3. Outline for policy study in co-operation with social science researchers in Tanzania

A policy study is an important input in order to support the dissemination of cleaner production in Tanzania. A number of social science researchers at University of Dar es Salaam and at Economic and Social Research Institute has been identified as potential participants in a policy study. These researchers have worked together with researchers from other countries with the assessment of the environmental consequences of the economic structural policies. A policy study should focus on environmental regulation as well as on other types of regulation having an impact on the environmental concern and commitment to cleaner production and resource savings. The policy study should as part of the theoretical base implementation theory, since the implementation of the regulation and the impact on the target group and the administrators (the so-called 'street-level bureaucrats) is very important. It is not enough to focus on the existence of laws and orders. That is, the policy study should see the regulation as systems or regimes that should fulfil a number of criteria in order to secure the wanted effect.

The regulatory regime theory points to the following aspects as important in policy studies:
- the object of the regulation
- the location of knowledge with different actors
- the set of available legal instruments
- the understanding of the regulated units, which has been the base for the regulation
- the resource needs with different actors
- the enforcement problems
- the shaping of the involved or needed professionals
- the building of institutional framework.

The implementation theory points to some further aspects to be included in the policy study:
- the policy formation process: conflict, casual theory, symbolic action etc.
- the implementation process: organisational and inter-organisational development, street level bureaucrat behaviour, target group behaviour,
- the implementation results: output (e.g. more companies inspected) and outcome (e.g. improved environment).

4. Outline for cleaner production case studies and manual

The experience from the CEPITA project and the first demonstration projects in CPCT points to the need for the collection of experiences with cleaner production in companies. That is, CPCT should make agreements with the companies they and others work with about some kind of reporting of the experience. The outline used in the evaluation of implementation of cleaner production in the CEPITA companies has shown to be useful as a guideline for the information that is needed in order to gradually build knowledge about not only the implementation of cleaner production, but also about

- the incentives and the barriers to cleaner production,
- the role of the public regulation
- the role of the business network and the knowledge network of the company
- the role of the local network, including the employees, the local population, the local authorities, local NGO's and CBO's etc.

It is recommended that a case study model contain the following information:

A. Introduction to the company

Overall description of the company: products, location etc.

B. Summing up in relation to the participation in the CP project:

- The activities in the company during the CP project: trainee, task force, management involvement, the activities carried out

- Which action plan was made ?

C. The overall development in the company since the end of the CP project:

Significant changes in the company concerning ownership, management, products, technology, staff etc.

Overall description of the implementation of cleaner production:
- Have some options been implemented ?
- Have new options been developed ?
- How has the trainee been involved ?
- Is there a cleaner technology task force ?
- Are specific persons, departments, committees etc. responsible for implementation of the action plan ?
- Which impact does the planning and implementation of cleaner production seem to have had on the development of the company (overall conclusions based on the in-depth analysis in chapter 5 of the case study report and presentation of the scores in relation to the indicators for systemic impact of cleaner production to the company) ?

D. Analysis of the options in the action plan and new CP options developed since the CP project

Information should be collected concerning:
I. The options developed during the project

II. The options developed since the project

For each implemented option are described:

Implementation status:
- Description of the changes taken place: equipment, materials, working procedures, organisation, product etc. Categorising the option in relation to

- Have the changes been sustained ?

- Whom was involved in the planning, implementation and sustaining of the option, inside and outside the company ?

- What was the background for the implementation: environment, economy, public regulation, demands from external actors etc. ?

- Has there been any conflicts in relation to the planning and implementation of the option ?

Economic aspects
- Investment costs

- Annual costs and savings. Pay back period.

Environmental impact:
- What has been the environmental changes related to the option (benefits and drawbacks) with respect to - wastes and emissions, resource consumption, working environment (occupational health and safety) ? Changes outside the company should also be described, if information is available.
Have the environmental achievements been documented ? How has the documentation been distributed ?

- Has there been impact on other aspects like quality ?

For not-implemented options are described:

For each option is described:

Implementation status:
- Has the option been discussed in relation to feasibility and implementation

- Description of the possible changes: equipment, materials, working procedures, organisation, product etc.

- How was decision about implementation (or not) made ? Is the option still a future possibility ?

- Whom was involved inside and outside the company ?

- What was the background for the decision: environment, economy, public regulation, demands from external actors etc. ?

- Has there been any conflicts in relation to the planning and lack of implementation of the option ?

Economic aspects
- Which are the possible investments ?

- Which are the possible annual costs and savings and the estimated pay back period ?

Environmental impact:
- Is information available concerning possible environmental impact (benefits and drawbacks) with respect to wastes and emissions, resource consumption, working environment (occupational health and safety) ? Changes outside the company should also be described, if information is available.

E. Analysis of the implementation of cleaner production in the company

Information is needed concerning the impact cleaner production has had on the company and the frames that the overall development inside and outside the company has given for the implementation of cleaner production.

Based on the information obtained about the planning and implementation of cleaner production a number of topics are discussed. General conclusions are drawn concerning the company and the future implementation of cleaner production.

The topics within this topic might have been discussed with several people in the company: the trainee, managers and employees that have been involved in the planning and implementation of cleaner production. It is important to be aware of any differences in the information, arguments etc. and not necessarily expect agreement. Differences should be highlighted.

This analysis should touch upon the following topics:

Overall environmental assessment of the implementation of cleaner production:
- Does the understanding of cleaner production in the company correspond to the international concepts of cleaner production ?

- Have there been any integrated considerations concerning cleaner production and end-of-pipe management of wastes and emissions ?

Interaction with the organisational, social, cultural, technological and economic development in the company:
- Which type of cleaner production options have been implemented and which types have been developed, but not implemented ?

- What are the future plans for planning and implementation of cleaner production in the company ?

- Has the company integrated environmental considerations into decisions about equipment, products, processes etc. since the CP project ?

- Have the company considered to implement some kind of environmental management ?

- Has preventive environmental aspects been integrated into existing or new procedures in the company ?

- Which impact has the implementation of cleaner production had on the economic performance of the company ?

- Have the company considered environmental impact outside the local community (global environmental impact, impact in other parts of the product network of the company) ?

- Which role have different groups of management and employees had in the implementation of cleaner production ? How has shop floor employees been involved: information, training, participation in planning and implementation etc. ? Has there been language problems in relation to the involvement of the employees ?

- Have procedures for material accounting been implemented ?

-Have the company taken steps to implement quality assurance ? Have their been any interaction between quality assurance and the implementation of cleaner production ?

Product network:
- Who are the suppliers and customers of the company ?

- Which role has the product network had in the implementation of cleaner production in the company ?

- Which topics seem to be important in the relations to the suppliers and customers: price, quality, reliability, environment etc. ? How do these aspects impact on the conditions for implementation of cleaner production ?

- Which seem to be the strengths and the weaknesses of the company in relation to suppliers and customers ?

- Does there seem to be some branch specific conditions for cleaner production ?

Knowledge network:
- How has suppliers, customers, consultants, research and development institutions etc. been involved in the implementation of cleaner production in the company ?

- How seem equipment, materials, products, processes etc. to be developed and modified in the company ?

Regulatory network:
- Which impact has public regulation (taxes, environmental standards and their enforcement, quality standards etc.) had on the implementation of cleaner production in the company ?

- Which impact does public regulation in general seem to have on this company ?

Local network:
- Which role does the local community seem to have had in the planning and implementation of cleaner production: e.g. demands from the local community for minimisation of the environmental impact of the company etc. ?
- How many employees come from the local community ?
- Does the company seem to have other types of relations with the local community: providing social and health services etc. ?

The language barriers due to the English language of the NCPC programme manual, especially in Zanzibar but to some extent also in the mainland, has pointed to the need for a manual in Swahili. CPCT has translated an introduction about cleaner production into Swahili, but it is recommended that CPCT develop a manual in Swahili. The base could be the NCPC programme manual, including the amendments made by Technical University if Denmark as counterpart, within occupational health and safety and within employee participation in cleaner production.

5. General progress of the activities in CPCT

In the Terms of Reference the role of CPCT is described as a co-ordinating and catalytic role in relation to the national implementation of cleaner production. A number of tasks are described. The progress in each of them as of the end of 1998 is shortly described in the following.

- Organise demonstration projects in industrial establishments: *the centre has organised two demonstration projects: one with focus in an industrial area in Dar es Salaam and one with focus in Zanzibar.*

- Promote the cleaner production concept through dissemination of information: *the centre has produced a few numbers of its newsletter and have organised a dissemination seminar based on the experience from the first round of demonstration projects.*

- Conduct audits for industrials emissions and wastes: *the demonstration projects have been based on training of trainees from the demonstration companies in carrying out clearer production assessments in their own plants. The seminars that have been part of the training was organised by the centre, but the presentations were given by Technical University of Denmark. In a few other companies the centre staff have gained first hand experience with cleaner production assessments, including the participation together with Technical University of Denmark in the auditing of the implementation in the CEPITA companies.*

- Produce technical publications: *The centre has not yet produced technical publications, but have contributed with one case study to a UNIDO publication from the NCPC programme.*

- Stimulate working groups: *the centre has not yet organised working groups, e.g .among cleaner production trainees after the end of the demonstration project or within certain branches. As described in chapter 6, there is a need for developing this activity in order to support the sustaining of cleaner production in the demonstration project companies and in order to disseminate the experience.*

- Offer training programmes in cleaner production practices: *the centre has not yet offered this kind of training but is a t the moment involved in a NORAD financed Train-the-trainers project, where general cleaner production training is offered.*

- Offer technical assistance: *The centre has in a few companies either organised technical assistance or given technical assistance through the centre staff.*

- Support evaluations on barriers and obstacles in the implementation of cleaner production techniques and technologies: *The centre has taken part in the evaluation of the experience with long-term implementation of cleaner production in the CEPITA companies together with Technical University of Denmark and Environmental Resource Consultant (ERC).*

- Collect information on all their experiences and store it a standardised information management system to allow for data exchange amongst the NCPC's: *Information is still no stored in a standardised way due to the late offer of these facilities by UNIDO.*

6. Evaluation and recommendations for future activities in relation to the development of the NCPC-concept

In order to support the dissemination of cleaner production as a concept in Tanzania, there is a need for new type of activities initiated by the centre and carried out by the centre together with other actors in Tanzania:

- more focus on mechanisms for dissemination of cleaner production experience through the concept of 'multipliers',
- more focus on the implementation of cleaner production in companies as a change process
- more focus on how public regulation can support the dissemination and sustaining of cleaner production in companies.

Activities within these three aspects are described in the following paragraphs.

6.1 Mechanisms for dissemination of cleaner production experience through the concept of 'multipliers'

The following proposals for dissemination mechanisms are based on input from the companies in the demonstration projects organised by CPCT and the participants in the dissemination seminar October 1997. Finally are the proposals based on analyses by Technical University of Denmark of the potentials and barriers to cleaner production in Tanzania as experienced during the demonstration projects and interaction with different stakeholders:

- Networking within branches

- Networking within bigger companies: TBL (Tanzania Breweries Ltd.), TSA Tanzania Sisal Authority) etc.

- Dissemination through industrial organisations (TCCIA etc.)

- Networking among cleaner production trainees

- National and regional governmental authorities

- Sustainable city projects

- Knowledge institutions: University of Dar es Salaam, TIRDO etc.

- Solid waste contractors

- NGO's

- Dissemination through media

Based on the companies that have participated in the present demonstration projects and the CEPITA-projects, there seems to be potentials for networking within at least the following branches

- cement

- sugar

- soap

- vehicle maintenance workshops and other similar workshops

- metal finishing companies

- beverage companies.

There is an urgent need for further networking with other institutions and stakeholders in order to accelerate the dissemination of cleaner production in Tanzania, since the centre with the present staff can only overcome a limited number of activities, and since a number of other stakeholders already have built some capacity within cleaner production and cleaner production related topics like e.g. environmental management. A crucial question is how to involve these other stakeholders. Some of the stakeholders could be able to build cleaner production as a new business area. This could, among others be,

- TIRDO, in relation to energy consumption and savings in companies, where TIRDO has a very good expertise, which the centre has not drawn upon.

- University of Dar es Salaam, in relation to postgraduate education, training and consultancy within cleaner production.

- TBS, in relation to training within environmental management.

- Consultant companies in relation to CP and environmental management in companies.

With respect to cleaner production within occupational health and safety, it might be more difficult to see, whom could be the future resource institutions. The Factory Inspectorate has, at the national level, built some awareness on cleaner production, but it might be difficult to combine the role of the factory inspectors as authority with a role as (paid ?) consultants. The occupational heath service centres in Moshi and Dar es Salaam could give advice to the companies on prevention of work related health problems, but the centres do not seem to have knowledge about the relations between workplace exposure, health, technical equipment, work organisation etc.

There is a need for an investigation of the knowledge infrastructure of Tanzanian companies in order to plan the dissemination activities in detail.

6.2 Implementation of cleaner production in companies as a change process

The centre need to build knowledge about the implementation of cleaner production in companies seen as change processes that involve a number of actors within the company and within the network of the company. It is necessary that the centre build an understanding of cleaner production implementation that goes beyond seeing the implementation as a rational and planned process. In the following is described the concept that the centre should try to adapt to. This could happen through co-operation with social science researchers.

There is a need for more in-depth knowledge on the dynamics of environmental strategies, practice and performance in companies in order to contribute to the development of theories concerning the dynamics of companies' environmental performance and to contribute to the strategic planning of research and regulation programs.
Many companies have participated in environmental projects, but the long-term implementation and impact is seldom analysed. The development of the environmental performance and practice in a company cannot, however, only be seen as project activities, but should be seen in connection with the over-all development of the company. When analysing the implementation process, it is important to focus on the understanding of the actors involved (or not involved !) and not only on the understanding of the researcher himself or herself. The term 'enactment' covers the approach where the researcher create and acquire (pick up) the understandings presented by the actors in and around the companies. The researcher plans her investigations from some kind of understanding of the company and the topics to be discussed. It is, however, important to be able to acquire the understanding presented by the actors and use this understanding to plan the further investigation. The environmental practice should not just be seen as a kind of 'willingness to confirm' relation. The companies base also their practice on expectations, norms and values, informal relations and expectations. That is, there might be discrepancy between value and practice and between plan and practice.

There need to be to focus on internal as well as external structures and processes within and around the companies, since dynamics can be created and hindered in both 'domains'.

The changes in companies' environmental practice and performance should understood as processes with different aspects:

- material aspects: how is the environmental burden changing
- managerial aspects, how is the company defining the important environmental problems, how are plans implemented etc.
- structural aspects: whom inside and outside the company is taking part in environmental oriented activities
- learning and cognitive aspects: how are different actors learning from the environmental experiences,
- social and political aspects: which alliances and conflicts are produced, maintained or solved through the environmental activities.

A cultural dimension could be added to focus on those values that seem to be implicit in the company concerning the products of the company, its impact on nature etc.

These aspects should all together make it possible to understand how and why environmental issues are dealt with and e.g. make it possible to understand if and why there are or are not correspondence between value and practice.

The material aspects focus on the relations between the environmental burden and technological and structural changes in and around the company. In the assessment of the environmental burden, the emissions and wastes and their potential impact should be assessed. A part of the managerial aspects is the focus of the environmental concern of the company:

- Is the focus on the company itself or also on the impact the company upstream and downstream in the product chain ?
- How could the aim of the environmental activities be characterised, like compliance, eco-efficiency or some kind of environmental strategy, where considerations about market potentials are considered ?
- How are environmental problems becoming recognised as problems: due to scientific evidence, due to care for the environment, pressure from authorities, pressure from suppliers or customers, pressure from local community etc.?

There should be focus on the fully development of the company (daily activities, changes in products and services), when the changes in environmental performance and practice in a company are analysed. That is, not over-estimating the environmental impact of planned environmental activities (like the implementation of a cleaner production action plan). Technological changes like changes in production or products, which are not considered by the company as environmental activities, might be more important in positive or negative terms for the environmental performance than planned environmental activities. It is interesting how actors in the company are aware of this

The rational and planned aspects of the environmental activities in companies should not be over-estimated. That is, there might not be a planned strategy behind, maybe the environmental strategy has to be understood as the activities actually undertaken. The activities might be more based on experiences and expectations than on throughout considerations on what is optimal. The environmental activities should be analysed together with the overall development of the company. Is there some kind of planned or unintended interaction ?

In the analyses of the external relations of a company four types of networks should in focus:
- the product chain (the material flow from cradle to grave),
- the developmental network (within the company, among suppliers and customers and R&D institutions, including banking, insurance etc.),
- the regulatory network (that is all types of regulations: environmental approval, product standards etc.),
- the local network (the local labour market, the neighbours etc.).

The interaction between these networks are important.

It is important also to focus on the relations the company level and the branch/societal level and not over-estimate the freedom of the individual company with respect to process, quality level etc. Also in the dissemination of environmental initiatives the branch level and supplier-producer relations might play a role.

Although the importance of project activities should not be overestimated, it important to analyse the role of project activities since many companies are carrying out projects as part of their environmental activities. The projects should be seen as a kind of "meeting" between (the social constitution of) the company and some external actors (or internal actors - e.g. from an environmental department) actors. The project should be seen as social constructed during the "recruiting" of participants supporting the project and during the planning and implementation of the project. There might be different objectives seen by different actors in a project.

A part of the project approach is the role of external and internal consultants as change agents in company changes. It could be consultants within the environmental field or it could be other types of consultants having an impact on the environmental performance. The role can be seen as contributions to the content of the changes and the change process itself. It is important to understand this contribution.

The relations between working environment and external environment are important to focus on because

- some companies include working environment in the environmental management system,
- measures made due to care for the environment might harm the working environment (and vice versa),
- some companies focuses on employee participation in environmental activities.

Finally it is important to analyse and understand the role of the employees:
- Are they motivated and able to take part in environmental activities. Why/why not ?
- What role are they given in project activities and afterwards in daily work and future changes ?

6.3 Public regulation as support of the dissemination and the sustaining of cleaner production in companies

As described in chapter 3, there is a need for a policy study concerning cleaner production in Tanzania. Such a study might point to some necessary changes in the public regulation, either in the environmental regulation or in regulation of business strategy, technological development, taxes etc. As pointed out in chapter 2 public regulation that should support cleaner production in companies need to focus on three types of measures:
- measures putting pressure on the companies, like the need to obtain environmental permits, increasing prices on resources like water and energy etc.
- measures supporting the development of the ability of the companies to work with cleaner production, like support for hiring consultants, support for hiring employees with environmental knowledge, funding of certification within ISO 14001, refund of environmental taxes if cleaner production measures are implemented etc.
- measures developing the frame for environmental proactive companies, like the development of long-term plans for phasing out of hazardous chemicals in order to give the companies time to change their production, co-ordination of the planning of local environmental facilities like waste water treatment facilities with the plans of the local companies with respect to changes in products, production capacity, implementation of cleaner production etc.

7. Evaluation of work undertaken in the sub-contract.

An evaluation of the first round of in-plant demonstrations has been carried out by Technical University of Denmark and reported in the second quarterly report within the subcontract.

The evaluation of the implementation of the cleaner production in the CEPITA companies has been planned and carried out with involvement of local DTU-associated consultants. The report from the evaluation has been delayed due to other, unplanned activities the team leader had to take responsibility for at his department at the Technical University of Denmark.

A summary of the barriers and incentives to cleaner production based on the experience from the CEPITA project and the first in-plant demonstrations is given in this final report.

An outline of a policy study is described in this final report.

An outline for cleaner production case studies is given in this final report.

The general progress of the CPCT activities is described and recommendations for future activities are given in this report.

Third quarterly report and final report within counterpart subcontract no. 97/219: Support to the National Cleaner Production Cente, Tanzania

Annexes: Background papers from CEPITA companies

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ANNEX 1

CASE STUDY REPORT

Company: Tanga Cement Company

Date: 25th May, 1998

Contact Person: Mr. Massawe

Designation: Quality Assurance Manager

Company Profile: The company was established in 1980 and stated commercial production in 1981.

- Cement production is a continuous process.
- Raw materials used are:
  - Limestone ($CaCo_3$)
  - Red soil - Clay components (Silicon Oxides ($Si0_2$), and aluminium Oxide ($Al_2 0_3$)
  - Gypsum ($CaS0_4 - 2H_20$ $Fe_2 0_3$)
  - . Energy sources are:
    Heavy Fuel Oil (HFO)
    Electrical Power.
  - . Unit Operations in Cement Production
    - Quarrying
    - Grinding
    - Blending
    - Pyroprocessing
    - Clinker grinding
    - Packing

Ownership: The company has been experiencing changes in ownership and management
i.e. 1987-1988 Saruji corporation (parastatal).
1987-1996 Holder Bank bought 60% of the shares but later sold the shares to ALFA of South Africa.

Types of waste:

(1) Energy waste - Through electrical inefficiency
- Fuel - HFO through inefficient combustion
- Diesel leakages and inefficient operations

(2) High level dust emission

(3) Low (ground) level dust emission

(4) Spillage's wastes - Process spillage
- Oil
- Water

(5) Environmental Deleterious contaminants
e.g. NOx, $C0_2$ SOx

2. MEETING WITH TRAINEE:

The trainee in CEPITA programme was Mr. Shoo. Mr. Shoo has been transferred to another department-Marketing Department. His duties especially CEPITA were taken over by his head Mr. Massawe - the Head of Quality Assurance. According to Mr. Massawe, he has been involved in CEPITA by preparing an number of reports which were presented by Mr. Shoo.

So, Mr., Massawe was the one who meet the Evaluation Team.

The cleaner Technology Task Force formed during CEPITA programme is said to be dormant one. They never meet to discuss the implementation status of the options.

3. MANAGEMENT INVOLVEMENT:

Through the company there has been experiencing changes in the Management. It has been also lucky that almost every management showed concern on cleaner production practices. This can be justified by the implementation status of the options as well as the development of a number of new options: Also by buying and budgeting for spares and equipment necessary for CP.

4. ACTION PLAN:

The company has a plan to implement CP options. So the setting of the budget for the implementation indicates the commitment of the management. There is a list of Gapex projects which indicates the budget and time frame.

5. OVERALL DEVELOPMENT IN THE COMPANY SINCE THE END OF CEPITA

5.1 Significant changes

Ownership: This has changed from Holder bank and now is ALFA of South Africa with 60% shares.

Products: Same - Cement

Technology: Similar operation processes. Only some improvements

Staff: Changes in top management

5.2 **Overall description of the implementation of CP.**

(i) Implementation of CP options

- Today Options:

  Almost all options have been implemented to certain extent some options in action plans and have been budgeted for.

- Tomorrow's Options

  Some options in the process of implementation and others in the action plan.

- After tomorrow's Options:

Only action plans but not budgeted for the management ready to learn on new technologies and improvements from others.

(ii) New Options:

A number of new Cleaner Production options have been developed and implemented since the end of the CEPITA project. During the visit the following were mentioned:

- Minimization of oil off-loading spillage's
- Minimization of cement bag breakage
- Minimization in relation to pre-heater build-ups

(iii) Trainee Involvement:

The trainee was fully involved before being transferred

to the Marketing Department.

(iv) Task Force:

The cleaner technology Task Force which was formed during the CEPITA project is said to be dormant. However, the whole approach of the implementation strategy has been altered. Reporting schemes for failures have been developed, here the supervisors are supposed to report on failures. The schemes are handed over to the process and Quality Assurance Department, which is responsible for investigations into the root-causes of the failures. These schemes are so supplement to the preventive Maintenance Programme at the plant. On this respect a number of persons-operators involved in the waste minimization efforts.

Table 1: **OVERVIEW OF THE PROGRESS IN IMPLEMENTATION OF THE OPTIONS**

	DESCRIPTION OF THE OPTION	IMPLEME-NTATION STATUS	ECONOMIC BENEFITS (FOR IMPLEMENTED OPTIONS)		ENVIRONMENT BENEFITS IMPLEMENTED OPTIONS		REMARKS/ COMMENTS
			INVEST-MENT COST	NET ANNUAL SAVINGS	QUANTITATIVE	QUANTITATIVE	
TODAY	Good House Keeping Good repair and maintenance i.e. (I) ESP and conditioning tower	Implemented (by improvement)	37 M TSH		High level dust reduction	High	Rehabilitation done by purchase of new parts for conditioning tower and rectifier for ESP. Hence return dust increased 8% to 200%
	(ii) Sealing of leakage areas, shielding of conveyor and improvement of extraction gates	Implemented			Low level dust reduction	High	Other re-design i.e. gaskets put on a conveyor belt and inlet chute been extended
	Energy Conservation (i) Improvement of HFO combustion	Implemented			Kiln energy reduced demand for HFO reduced	Low	Some spare parts are required to further improvement of pre-heaters to increases efficiency.
	(ii) Re-use of waste	Implemented			Reduction	High	

	oil				waste oil pollution		
	(iii) Power factor correction for electrical waste	Feasibility study done					
	Improvement in process operation	working on kiln heat balance					this is a kiln optimization programme being carried out by Danish Students doing their extension activity at TCC.
	New drilling equipment with dust collector	Part of Capes projects for 1998					
	Repair control and measuring equipment	Implemented	TSH.2.08m		Reduction gaseous emission	Low	investment for new gas analyses has been scheduled for June, 1998
	Repair/repla-cement of dust filters	Being Implemented			Reduction dust emission		There is frequent changes of fabricfilters
	installation of waste fuel back-end firing system	Feasibility not yet					Investigation going on. Alternative full identified are sisal waste, bagass and municipal waste. Carrying experiments with back firing with

							coal
	Repair/Implement of water pipes to the factory and return water pipes in the factory	not Implemented					This require careful planning so that they can be carried out fast since these water pipes carry the cooling water for the factory.
	Possibility of modification and installation of a new ESP	Not feasible at the moment					The investment not feasible at the moment, since decreases in dust emission can be obtained without investment
	Possibility of installing a new pre-calciner	Not Implemented					This is still considered as a future possibility
	Possibility of installing/replacing the fuel burner	Investigation on-going			If implemented energy conservation - Nox reduction		Investigation on-going in relation to dual burner (coal HFO) the Coal project done in relation to a burner with low primary air consumption, this can reduce NOX.
	Possibility of process and material changes	Investigation on-going			If implemented waste reduction		Investigation in order to increase us age of yellow clay aiming in

							waste reduction. Investigation of adding limestone in cement grinding to lower clinker product
	Minimization of Oil-loading spillage's	Being Implemented			Reduce Oil-Spillage's	medium	Done by putting pressure on supplier BP. Controlling the coding not to so high pressure
	Minimization of cement bag breakage's	Implemented			Dust reduction energy conservation	High	Improvement done by supplier on the cement bags by using more glue and the bottom if the bags given more stitches.
	Minimization in relation to pre-heater build-ups	Investigation on-going					Causes for build-ups he been identified rehabilitation of air common beaching considered to minimise the blockages in the preheater and the row will inlet chute.

4. Analysis of the options in the action plan and new CP options developed since the project.

4.1 Options developed during the project.
This is a description of the achievement of Tanga Cement Company in relation to the Cleaner production options identified in the action plan developed during the project.

4.1.1 Implemented Options

Today's Options

- Repair and maintenance of:
  (i) ESP and conditioning tower
  Rehabilitation was done by purchase of new parts for conditioning tower and rectifier for the ESP. This has increased the return dust from 8% to 200%.
  Investment cost involved was Tshs.37m.

  (ii) Sealing of leakage areas and improvement of extraction gates.

  All the leaking areas have been sealed, some re-design was done by which involved putting gaskets on conveyor belts and extending the inlet chute. This has reduced the amount of dust emitted.

- Energy Conservation

  (i) Improvement of HFO combustion

  The introduction of the pre heaters has increased the efficiency of HFO combustion. This implies the reduction of kiln energy and hence the demand for HFO is therefore reduced. The investment costs and the savings were not reported.

  (ii) Re-use of waste oil.

The waste oil is collected, filtered and then pumped back to the storage tank for re-use. This has reduced oil pollution at the surroundings.

TOMORROW'S OPTIONS

- Repair control and measuring equipment.

  The repair work was done costing Tshs.2.08m. However, investment for new gas analysis was scheduled for June, 1998. The overall environmental impact was the reduction in gaseous emission.

- Repair/replacement of dust filters.

There was an increase in the frequency of changing the fabric filters. The impact was the reduction in dust emission.

4.1.2 For not Implemented Options

Today's

- Energy conservation:

  ⇨ Power factor corrector for electrical Waste.

  A feasibility study has been done. Working on implementation for malitus.

  ⇨ Improvement in process operation

  The company is working on kiln heat balance. This is being carried out by two Danish Students doing their extension at TCC.

  ⇨ New drilling equipment with dust collector

  This was incorporated in the Capex projects for 1995. The project is still seen as a future possibility.

Tomorrows Options:

- Possibility of modification and installation of new ESP.

  This was reported not feasible due to heavy investment involved. However the management is convinced that reduction in dust emission can be achieved by improvement instead of the required investment.

- Possibility of installing a new pre-calciner.

  Though not yet implemented but the management still consider it as a future possibility.

- Replacing the fuel burner

  Investigations on-going in relation to; dual burner (coal + HFO) through the coal project and a burner with low primary air consumption.

- Process and material changes

  Investigation on-going in order to increase usage of yellow clay aiming at waste reduction. There is an experiment going on adding limestone in cement grinding so as to lower the demand for clinker.

New Options after CEPITA

Implemented Options:

- Minimization of Oil-loading spillage.

  This was implemented after putting pressure on the supplier (PB) by the management. There was a reduced oil spillage according to the management.

- Minimization of Cement bag breakages.

The management requested the supplier to improve the quality of the cement bags so as to reduce the breakage. The supplier improved the bags by using more glue and giving more stitches to the bottom of the bags.

For not Implemented Options.

- Minimization in relation to pre-heater build-ups.

  Causes for build-ups have been identified; rehabilitation of air cannon being considered to minimize the blockages in the pre-heater and the raw mill inlet chute.

ANALYSIS OF THE IMPLEMENTATION OF CLEANER PRODUCTION IN THE COMPANY

5.1 Production Value:

(i) Implementation Status is large as the share of implemented options on total number of prevention options is 44%.

(ii) Economic impact is large for all implemented options since they are mostly today's options with immediate results.

(iii) Environmental impact is large for almost all the implemented options.

5.1.2 Technical Impact

A Big number of implemented options can be categorized to as environmental improvement. However there are a number of re-design 5% the plant i.e. putting gaskets on a conveyor belt and extending inlet chute which can be categorized to as environmental innovation.

5.1.3 Systematic Impact:

5.2 Overall environmental assessment of the Implementation of cleaner production:

The efforts and initiatives being taken by the company in waste minimization indicate that they are in line with the international concepts of cleaner production. This can be demonstrated by the fact that a number of options which were developed during CEPITA programme have been implemented or are in the process of implementation new options (after CEPITA) have been developed.

Interaction with the organizational, social, cultural Technological and economic development in the company.

Type of cleaner production options Implemented. Almost all CEPITA options have been implemented or are in the process of implementation except options which require heavy investment. All at new developed options have been implemented.

Integration of environmental considerations into decision:

The company considers environmental protection as at tool of planning the company has a number of activities going on i.e. correspondences, investigation etc. all of which focus on environmental protection environmental management.

The company is implementing the Capex project which shores the seriousness of the management on environmental protection.

Impact on economic performance

The implementation of learner production has shown a positive impact on the economic performance of the company.

Roles of different groups of management and employees in the implementation of CP.

Almost each and every group in the company has played a respective role in the implementation of CP. The top management has accepted the ideas and thus agreed to commit funds for implementation. The different departments i.e.

mechanical and maintenance, production dept. etc. have taken the task of implementing the developed options. A reporting scheme has been established to monitor the failure in the whole plant. In this case every supervisor is supposed to report on failures.

Procedure for material accounting

The company has tried to influence the suppliers of cement bags to improve the same so to reduce the losses due to failures of bags.

Quality Assurance:

The company has formulated a quality assurance programme where activities identified are reported on their progress.

5.3 Product Act work:

Supplier and Customers:

The major suppliers are those who supply the company with, HFO-BP, Cement Bags, Electrical energy, water.

The major customers are dealers in construction activities.

Role of Product Network:

Implementation of Cleaner Production has necessitated the improvement of Cement bags. The supplier was influenced to re-design the cement bags by using more glue and the bottom of the bags are given more stitches.

Putting pressure on the oil supplier BP has decreased the amount of oil off-loading spillage's BP now is not allowing old lorries to load to so high pressure in their tanks as before and that new lorries need to be approved by BP.

Important topics in relation to suppliers and customers are: quality, environment, market.

These aspects influence the suppliers and customer to comply with the condition set.

Strength of company in relation to suppliers and customers:

- Purchasing power
- Competition of suppliers
- Potential Market

Weakness of the company in relation to suppliers and customers

- Prices

If the company is strong in relation to suppliers and customers then it can influence or inset cleaner production conditions which will definitely implemented.

5.4 Knowledge Net Work:

Suppliers, customer, consultance, research and development institutions have been involved in the implementation of CP in the company follow:

- Supplying quality products

- Complying to loading conditions.

5.5 Regulatory Network

DESCRIPTION PART (TCC)

Environmental Objective of CP measures	Classification of Environmental Impact of CP measure		
	Low	Significant	Large
1. Cleaner Production			>50 reduction of waste
2. Material and energy efficiency improvement			>25% improvement of the efficiency use of target input
3. Substitution	No substitute of materials have been made		

Table 2: Classification scheme for the environmental impact of CP

Tanga Cement Company	**Start of project CEPITA 1995**	**Present situation**	**Improvement change %**
• Electricity consumption (KWH/ton)			
• Oil consumption (HFO) (tone/day)	140		
• Water consumption (ton/ton)			
• SP emission (tone/day)	91		

Table 3: Quantitative Assessment for TCC

Evaluation criteria	**Parameter**	**Practical Value of CP Assessment**		
1. Implementation status	Implemented options in total number of CP options			>25%

2. Economic Impact	Overall pay back period for all CP measures		X	
3. Environmental Impact	Environmental Impact of the prevention measures		X	

Table 4: Classification scheme for "Practical Value"

Process	**Environmental Improvements**	**Environmental Innovations**
Quarrying	Minimization of dust during drilling process	New drilling equipment with dust collector
Material transportation (conveying)	Material and dust reduction by which method	• Use of bin storage. • Gaskets put on conveyor belt. • Inlet chute extended
Electrostatic Precipitator (ESP)	Dust reduction by what?	• Rehabilitation done for conditioning tower and rectifier.
Utilities/general	- Improvement of HFO combustion - Reduction of waste oil pollution	- Improvement of pre-heaters to increase efficiency - Re-use of waste oil
Packaging	- Dust reduction	- Improvement done on Cement bags. Use more glue and stitches

Table 5: Environmental Improvement and Innovation

Environmental Management Practices	**Indicators for significant progress in implementing respective (environmental) management practices**
1. Environmental Policy and/or objectives	- compliance with present environmental concerns. - The efforts and initiatives being taken by the company indicate the seriousness
2. Production	- The company is implementing the Capex

management	project which shows the seriousness of the management. - A reporting scheme has been established to monitor failures in the plant.
3. Employee involvement	Operators are involved in monitoring the failures in the plant. Each member involved in the Capex project.
4. Material accounting	Efforts to control: - cement losses due to bag breakage. - Oil losses due to off-loading. - Kiln head losses.
5. Waste Minimization Assessment	About 44% of the waste minimization options implemented. More investigations and consultations still going on for further improvement.

Table 6: Indicators for progress in implementation of environmental management practices conducive to up take Waste Minimization.

CONCLUSION:

A number of options which were developed during CEPITA project have been implemented or are in the process of implementation. New options (after CEPITA) have been developed. Options which are said to be pending are those which require heavy investment.

The management seems to have a vested interest in Cleaner Production principles. The company has a number of activities focussing on environmental protection.

The company has established international relations with sister companies on new emerging technologies for waste minimization.

The company has a close contact with the customers/suppliers and has managed to influence some changes in some of the items supplied so as to minimize waste generation though local legislations are not that effective the company does abide to global concern and directives.

Recommendations:

To boost the company's tempo it is important to establish a network mechanism with relevant authorities i.e. Environmental agencies, so that initiatives made are known, recognized and recorded. The system will facilitate in the assistance of the company.

It is important to have a full record of the programmes and the economic and environmental benefits achieved which will indicate the contribution of the company in environment protection efforts.

The company should be assisted both externally and internally, to play a training role for other companies.

To

Leslie M. Massawe

(Process and Quality Assurance Manager)

Tanga Cement Company Ltd.

Fax 053 - 46180 7 PAGES

Dear Mr. Massawe

Concerning the CEPITA evaluation

Thank you for a good visit last week.
I have tried, here in Dar es Salaam, to write a resumé of the implementation of Cleaner Production at Tanga. I have enclosed this resumé. I have put a number of questions in there, since there is some information I would like to have and some information we might have misunderstood.
I am in Dar until Saturday (Cleaner Production Centre of Tanzania). I will phone one of the following days to get a talk about the resumé and the questions we have raised.

Kindly greetings Michael S. Jørgensen

CASE STUDY REPORT

Company: Tanga Cement Company

Date: 25th May, 1998

Contact Person: Mr. Massawe

Designation: Quality Assurance Manager

Company Profile: The company was established in 1980 and stated commercial production in 1981.

- Cement production is a continuous process.
- Raw materials used are:
  - Limestone (CaCo 3)
  - Red soil - Clay components (Silicon Oxides ($Si0_2$), and aluminium Oxide ($Al_2 0_3$)
  - Gypsum ($CaS0_4$ - $2H_20$ $Fe_2 0_3$)
  - . Energy sources are:
    Heavy Fuel Oil (HFO)
    Electrical Power.
  - . Unit Operations in Cement Production
    - Quarrying
    - Grinding
    - Blending
    - Pyroprocessing
    - Clinker grinding
    - Packing

Ownership: The company has been experiencing changes in ownership and management
i.e. 1987-1988 Saruji corporation (parastatal).
1987-1996 Holder Bank bought 60% of the shares but later sold the shares to ALFA of South Africa.

Types of waste:

(1) Energy waste - Through electrical inefficiency
- Fuel - HFO through inefficient combustion
- Diesel leakages and inefficient operations

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(3) Low (ground) level dust emission

(4) Spillage's wastes - Process spillage
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e.g. NOx, $C0_2$ SOx

2. MEETING WITH TRAINEE:

The trainee in CEPITA programme was Mr. Shoo. Mr. Shoo has been transferred to another department-Marketing Department. His duties especially CEPITA were taken over by his head Mr. Massawe - the Head of Quality Assurance. According to Mr. Massawe, he has been involved in CEPITA by preparing an number of reports which were presented by Mr. Shoo.

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3. MANAGEMENT INVOLVEMENT:

Through the company there has been experiencing changes in the Management. It has been also lucky that almost every management showed concern on cleaner production practices. This can be justified by the implementation status of the options as well as the development of a number of new options: Also by buying and budgeting for spares and equipment necessary for CP.

ANNEX 2

EVALUATION OF CP IMPLEMENTATION IN CEPITA COMPANIES

1. INTRODUCTION

GALCO is a large scale producer of corrugated iron sheets based in Dar es Salaam. Since 1996 the company is jointly owned by Comcraft of London (60% shares) and Government of Tanzania (40% shares). The former have similar plants in Kenya, Uganda, Zambia and Malaysia. The company participated in the CEPITA pilot project through Mr. Patrick, a mechanical engineer, who attended the training and workshop programmes.

2. PARTICIPATION IN CEPITA PROJECT

The management of GALCO showed interest in implementing CP programmes. The first initiative was to allow one of its engineers to attend all CP seminars and training workshops. A task force was formed to include one stores man and all rollmen working with unit operations. Cleaner production assessment was carried out during which a total of 13 options were identified and evaluated. These were prioritized in three categories namely to-day options (11 nos.) tomorrow options (1 nos) and after tomorrow options (1 nos.)

3. OVERALL DEVELOPMENT IN GALCO SINCE END OF CEPITA

3.1 SIGNIFICANT CHANGES IN THE COMPANY

Two years after conclusion of the CEPITA project, the majority of the company shares were taken by the private sector (Comcraft). There has been a change in the management structure since the close of CEPITA. Aluminum Africa, the mother company had six divisions namely ASBESCO, STEELCO,STEELCAST, PIPECO, ALUCO and GALCO. ASBESCO is now closed and STEEL CAST, of steel billets producer has been taken over by another company MM integrated Steel Mills belonging to Motisun Holdings Ltd.

The post of divisional manager in the company organigram has been scrapped and instead a General Manager is in place and incharge of the so called Steel Division which comprises GALCO, PIPECO and STEELCO.

GALCO I, the old factory, was closed down by the new management in July 1997. The reasons for the closure include high raw material consumption and poor quality of finished product due to outdated technology.

3.2 OVERALL DESCRIPTION OF THE IMPLEMENTATION OF CP

The CP task force did not meet any more after the CEPITA project and no new options were generated. Only the implementation of the CP plan was followed up by the trainee.

During the CEPITA project, a total of 13 CP options were identified and classified as today options (11 nos.), tomorrow options (1 nos) and after-tomorrow options (1 nos). Some good house-keeping options were implemented in the old and /or the new plants (GALCO I & II).

3.3 OVERVIEW OF THE PROGRESS IN THE IMPLEMENTATION OF OPTIONS

4. ANALYSIS OF OPTIONS IN THE ACTION PLAN AND NEW OPTIONS DEVELOPED SINCE CEPITA

4.1 OPTIONS DEVELOPED DURING THE PROJECT

4.1.1 IMPLEMENTED OPTIONS

(a) Option: Fabrication and fixing ammonia exhauster at galvanizing unit

Implementation status

An exhaust fan to remove fumes of ammonia from the operational area was fabricated and installed thus making the wet galvanizing process less polluting to the working environment. This option was implemented in the old plant which is now closed since July 1991. The new plant is also fitted with an ammonia exhauster. It is therefore true to say that the change initiated during the project has been sustained by the company management.

Economic aspects

Investment costs towards the implementation of this option is estimated at US $ 1547 with an annual saving of US $ 700 and a pay back period of 24 months.

Environmental impact

Implementation of this option has resulted in a better internal working environment, i.e. improved occupational health and safety which is a prerequisite for improved productivity.

(b) Option: Recycling of metal scraps

Implementation Status

Before the new management took over the company and eventually closed down the STEELCAST division, metal scraps from GALCO used to be passed over to the former plant for melting and casting into billets. This product was then transported by trucks to Steel Rolling Millings in Tanga (approx. 570 km away) for manufacture of rolled steel bars of various sizes for construction purposes. The steelbars were then transported back to Dar es Salaam for sale. This business proved uneconomic as the rolled iron bars could not compete with imported ones or even those manufactured in Dar es Salaam itself on the basis of price.

Economic aspects

The metal scraps are now sold to various Dar es Salaam based Steel Mills that have furnaces and capacity to roll the billets into bars.

Environmental impact

No obvious environmental impact can be seen with regard to implementation of this option other than the absence of the pile-up of scraps in or around the factory premises.

4.1.2 Options Implemented Since Cepita

(a) Preheating of furnace oil

Implementation status

Furnace Oil reserve tanks (two nos.) are fitted with electric heaters that preheat the oil prior to being pumped through another on-line heater from which the oil reaches the burners for combustion. These heaters sometimes breakdown resulting in cold furnace oil being pumped to the furnace. When the oil temperature falls below 90°C, the combustion at the furnace becomes incomplete, emitting a lot of smoke consisting mainly of carbon monoxide into the atmosphere. To avoid recurrence of this situation, steam from the boiler was supplied to heat all the pipes supplying oil to all eight (8) burners. To ensure no heat losses both steam energy and oil supply and return pipes were well lagged with felt wool insulating material. This option ensured 80% total combustion of oil thus reducing pollution due to carbon monoxide formation, reduced fuel consumption at the burners by 20% and also eliminated the need for frequent cleaning of oil filters as furnace oil at 90°C becomes less viscous.

Economic aspects

No record could be easily supplied on the investment costs or savings in financial terms. However in the GALCO II plant, furnace oil usage is about 35 litres per ton of product compared to 27 litres for the plant in a neighbouring country, Kenya.

Environmental Impact

Notable impact on external environment is the reduced emission of carbon monoxide into the atmosphere through the stack.

(b) Neutralizing degreasing and pickling solutions before discharge

Implementation Status

The pickling solution, a dilute solution of hydrochloric acid, becomes less strong with usage due to spills of the alkaline degreasing solution (sodium hydroxide) carried over by the metal strip to the acid tank. The carry over of the degreasing solution is minimized by pressure adjustments on the pinch rollers to ensure proper squeezing. The strength of the degreasing solution is regularly restored by addition of calculated quantities of sodium hydroxide and water. However with prolonged usage this solution also gets dirty due to greases and has to be disposed. Every two to three months, the degreasing solution and the pickling solution are discharged together so that they neutralize each other. Follow up is only done by visual inspection due to absence of measuring equipment, typically a pH meter.

Economic aspects

No costs are involved in the implementation of this option and the savings are difficult to ascertain. However if well done, one would expect reduced corrossion of sewage systems such as metal pipelines, steel reinforced concretes and the like.

Environmental impact

The neutrality of the mixed degreasing and pickling solutions is not known. However if the mix is sufficiently neutral one would expect minimized destruction of plant and animal forms down stream.

(c) **Fitting self-locking taps on drinking water tank**

Implementation status

Self locking valves were fixed on drinking water tank with a view to minimize wastage.

Economic aspects

No record was provided on the cost of implementation of this option but it is assumed to be very small. Savings are even more difficult to estimate as no previous records of wastage are available for comparison. However it is reasonable to assume that there has been a more efficient consumption of water as a resource.

Environmental impact

Implementation of this option may be seen to have reduced the volume of factory effluents though by a very small margin.

4.1.3 **OPTIONS NOT IMPLEMENTED**

a) **Installation of steam return line**

Implementation status:

Waste water arising from condensation of steam is at present drained out to the sewer. This situation could be changed by providing return line of condensed water to the boiler. This would improve boiler efficiency since the return water would be relatively warm.

This option was however not implemented due to high costs of fixing return line and lagging thereof. The level of investment required could not be obtained.

b) **Running the dry process**

Implementation status

At present the wet ammonium chloride flux method is used. The company may in future use the dry processing method which entails passing the metal sheet through a liquid zinc ammonium chloride flux. Dry processing is less polluting than the wet process (no ammonia fumes and therefore better working environment) but requires the use of hot air to dry the flux which is itself obtained from the burning of kerosene. The equipment for dry processing is already secured at the company but not yet installed because the zinc ammonium chloride flux is considered a very expensive input. The kerosene based hot air generators would require approximately 400 litres of kerosine per day.

c) **Chromate treating**

Implementation Status

No arrangement is in place for treating the used chromic acid and every one month or so some 600 litres of the chemical is discharged straight into the sewer. The actual consumption of chromium is 0.2 kg per ton of product. This is same as 20 kg per day or 360 kgs per month. No proper reason could be given for the non-treatment but it would appear that the know-how is lacking and there has been no external pressure for the company to act.

5. ANALYSIS OF THE IMPLEMENTATION OF CP IN THE COMPANY

Under the new management, environment issues are considered under the aspects of productivity improvement or house keeping in the company's cost accounting. According to the General Management, the Chairman of the company is environment conscious and cleaner production is considered a company policy. The quarterly performance review meetings for General Managers of Comcraft enterprises provide an opportunity for the General Manager of GALCO to export CP ideas to sister enterprises.

In the plant itself, each unit operation is on constant examination for cleaner production opportunities and the team meets once every two weeks with the new management to communicate their observations. Generally, all employees appear proud of the clean working environment and include environmental consideration in their operating practices.

The team members are mostly graduate engineers who understand the concept of CP in the same way it is understood internationally. The company also understands that a mix of both CP and end-of-pipe management of wastes and emissions would be most effective.

Most of company's involvements in cleaner production occurred during the project period with only a few CP measures being imported for implementation from external sister companies after the project period.

All in all the systemic impact of CP assessments and implementation within the company may be rated as significant despite changes in the company management and the closure of GALCO I.

With continued follow-up guaranteed from the NCPC, CP is bound to be taken as a company management tool rather than the exception. This trend of events will be further supported in this and other CEPITA companies when the environmental legislative framework is concluded by the government to complement the existing national policies on sustainable industrial development (1996 – 2020) and environment.

TABLE 1

S/NO	CP Option	Impleme-ntation Status	Economic benefits (only for implemented options)		Environmental benefits (only for implemented options)		Remarks/ Comments
			Investment Costs (US $)	Net Annual Savings (US $)	Quantitative	Qualitative	
1.	Fabrication and fixing the ammonia exhauster at galvanizing unit	1	1547	700	Reduction of ammonia emissions	high	No ammonium fumes implying a better work environment
2.	Recycling of metal scraps	1	-	low		high	Approx. 30.5 tons per month used to be melted into steel billets for eventual manufacture of steel bars outside the premises. Unfortunately these could not compete with imported bars due to high internal transport costs
3.	Preheating of furnace oil	1	-	fuel consumption reduced by 20%	Reduction of CO emission	high	Frequency of cleaning oil filters reduced
4.	Neutralizing degreasing and pickling solutions before discharge	1	nil	-	Less destruction of living forms down the stream	high	The degreasing (NaOH) solution and the pickling (HCL) solution are discharged together so that they neutralize each other
5.	Fitting self locking taps on drinking water tank	1			Reduced wastage of water	low	-

Implementation Status

1 = Implemented during CEPITA
2 = Implemented since CEPITA
3 = Feasibility NOT yet proven
4 = Proven or considered unfeasible

TABLE II (Implementation of Options Generated after CEPITA)

S/NO	CP Option	Impleme-ntation Status	Economic benefits (only for implemented options)		Environmental benefits (only for implemented options)		Remarks/
			Investment Costs (US $)	Net Annual Savings (US $)	Quantitative	Qualitative	Comments
1.	Use trolley on rails instead of fork lift for material handling	2		Saving on fuel for fork lifts	saving on petrol/diesel	low	Useful idea imported from other companies
2.	Use belts instead of wire strings to handle raw materials (CRC - coils)	2	-	-	-	-	Improved occupational safety by minimizing risk of injury

ANNEX 3

CEPITA EVALUATION REPORT

Company: Arusha Galvanizing Company (AGACO)

Contact Person: Mr. Mamuya - General Manager

1. Introduction to the Company

Agaco is a small-scale industry based in Arusha town and workshop is situated at Arusha Region's SIDO - Azimio Industrial Estate. The company deals with galvanizing objects made of metal sheets and iron sheets like water buckets, water storage tanks, and all types of gutters (round and square). The unit operation is divided into three sections:

Cleaning
Galvanizing
Finishing

There was a fabrication department which was situated out side the workshop. A finished product made of metal or iron sheet was brought to the workshop for galvanizing. Due to financial constraints the department was closed last year and a small department is built as extension hall to the company's workshop. The company also offers to customers who bring their own finished and unfinished products for galvanizing.

The company is owned by three Tanzanians with Mr. Mamuya, a chemical engineer by training as the overall responsible for the company's technical department.

2. Participation in the CEPITA Project

AGACO was selected to participate in the CEPITA project between 1994 - 1995. The management of the company were willing to invest time and energy for the project. A trainee Mr. Mbega, a technician by training was recruited to attend CEPITA training and workshop sessions. The objectives of the training and workshops were to train a group of 12 CEPITA trainees in cleaner production concepts, waste minimization techniques and implementation of cleaner production technologies. During the CEPITA project the trainee at AGACO had executed a pre-assessment and assessment of cleaner production options and implementation of cleaner production action plan.

During the CEPITA project's consultants had visited AGACO more than three times. The trainee was one of the most active and enthusiastic participants among the trainees. Even though the trainee background was a secondary school O level leaver with a vocational

education training of three years he had a good understand of cleaner production concept and assessment of CP options. Task force was not formed during the implementation process but most of the few works at the factory were aware of the CP concept. CP awareness signs here hanged in the factor, especially in the cleaning and galvanizing operations.

The CEPITA trainee was terminated his job after one year when the CEPITA project wound up its activities. The Evaluation Team met Mr. Mamuya who was involved in the CP activities carried out by the trainee. The cleaner production task force was never formed during and after CEPITA project.

An action plan was made for implementation of CP options as shown in Table 1. The plan was developed in close cooperation with the management and because of the trainees' commitment to CP. Unfortunately, when the trainee began to implement the CP options one of the managers of the company was not happy with expenses to be incurred by the project. According to the evaluation this was the main cause of termination of the trainee job.

After the trainee left the company the general manager has been following-up the CEPITA activities without implementation of the CP the action plan.

3. The overall development in AGACO since the end of the CEPITA project

3.1 Significant changes in AGACO since the CEPITA project

The company is still owned by three major shareholders. Due to the increased competition the company has been diversified into other business ventures like edible oil milling, construction, etc. One of the directors is fully involved in these activities since 1996. Most of the workers interviewed during our several visits to the company informed us that the management has not been focusing on actively promoting the products marketing and deliver orders in time, and the management has not been concerned with the workers welfare and improvement of working environment.

After the trainee left the company no new options have been developed. The person who is responsible for implementation of the action plan has been the general manager. A cleaner production task force has never formed by the trainee and does not exist at present.

3.2 Overall description of the implementation of cleaner production

Table 1 summarize the progress in implementation of the cleaner production options developed as part of CEPITA project. A number of options were implemented at that time and they seem to have been sustained without following the action plan.

The amount of galvanizing work has decreased during the recent years. Nowadays galvanizing is only done three days a week. One of the reasons for the decrease in demand for galvanized items is increased competition from similar products made of plastic, like water buckets. Therefore AGACO is trying to diversify its production. That is, to manufacture new products for electricity authority and to find new customers for galvanizing their products. According to the manager, a number of customers, however, let their products galvanize at AGACO's plant due to the high quality of the galvanizing process done at the company. The galvanizing companies in the industrialized countries are doing well, since they have big customers by galvanize road fringes, power line pillars steel for construction of buildings with window glass frames.

AGACO is also selling soldering liquid based on the spent acid from the acid bath in the cleaning section of the company. This spent acid contains zinc chloride. AGACO adds more zinc chloride, ammonium chloride and some boric acid. The soldering liquid is sold in the Arusha-Moshi region. About 50% of the spent acid is used this way. The rest is used for neutralizing the alkaline bath before discharging it into the sewer.

The iron sludge from the acid bath is dried and then dumped nearby. The slag from the zinc melt (galvanized ash) has been exported to UK and India. The usual customer has not, however, bought slag recently. This may be due to the ban of export of waste, including metal scrap.

4. Analysis of the options in the action plan and new CP options developed since the project

4.1 Options developed during the project

This is a description of the achievements of AGACO in relation to the cleaner production options identified in the action plan developed during the project.

4.1.1 Implemented options

Today's options

Thoroughly maintenance of vat (tank)

The leakage at an acid tank with hydrochloric acid have been repaired and another tank that was totally damaged by the liquid (sodium hydroxide ?) has been replaced by a reserve tank.
The savings in the consumption of liquids, due to the decrease in leaking

liquid is not known, since the bath normally is kept/used until it does not work any longer. (This happens, when the bath does not clean the items good enough due to a too high concentration of iron and zinc chloride and thereby a decrease in the acidity of the bath. The quality of the bath is checked by checking the surface of the cleaned item or by measuring the pH, either with pH paper or by titration). The fewer leakage has improved the working environment in terms of less risk for etching of the skin.

Good working (garments) protection equipment

According to the manager, it has not been possible to order new acid proof gloves and overalls. In stead the workers are provided with acid proof aprons and with rubber gloves. The workers are also provided with some kind of nose masks.

Minimization of energy consumption at the fluxing bath

The electricity consumption has decreased by around 5 % because the heating of the fluxing bath (with zinc ammonium chloride) has been taking away. That is, the fluxing bath is now a cold bath. In stead the heating of the items take place by letting the items hang over the zinc bath for some minutes before dipping them into the melted zinc.

Preventive maintenance programme (blockage and chain)

The chain hanging down from the crane and holding the items over the bathes was given some oil in order to make the movements more smooth. The hook was improved to be able to hold the goods better. This has minimized the risk for items falling from the hook down into a bath and thereby decreased the risk of the workers getting etched and the risk of wasting chemicals.

Reduction of chemical loss at store

Chemicals are lost at the chemical store due to careless handling of the concentrated acid (and other chemicals). The container where the chemical store is has also been corroded. It has been emphasized to the workers that they should be more careful in their handling of the acid

Fiber wool must be used well to reduce heat loss from the melting bath

According to the manager it has not been possible to purchase more fiber wool for better insulation of the zinc melting bath. According to the trainee, however, the cover for the zinc melt has been improved by putting

the fiber wool into a metal frame.

Tomorrow's options

Prolong life time of cleaning and degreasing bath

The life time of the bathes has been prolonged by changing the working routines a little. It has been emphasized to the operators that they should let the items drip better off by letting them hang for longer time over the alkaline bath and the acid bath. Furthermore it is important to wash or rinse items in water after the alkaline bath (before the acid bath) and after the acid bath (before the fluxing bath) in order not to mix the chemicals and neutralize the solutions. It has been easy to implement these changes since the cleaner production trainee was the operator himself. After the cleaner production trainee left, the foreman has been able to pass the experiences over to the new operator, since the foreman also took part in the implementation of the cleaner production options. The new operator has also worked in this part of the plant before.

The manager has not calculated the savings. The life time of the bathes depends on the amount of galvanizing work. Normally 2000 liters of alkaline solution and 5000 liters of acid lasts for 4-5 months, but the manager never compares the lifetime of the bathes with the amount of work that has been carried during that period.

Increasing dimension of fluxing bath

The trainee had suggested to increase the dimensions of the fluxing bath with higher concentration (three times higher) of zinc ammonium chloride, since this bath is too small for some of the items. This means that dry, concentrated zinc ammonium chloride has to be sprayed on the items, which caused some waste of the chemical (falling on the). This bath is used for items that are difficult to galvanize (?).

It has not been economically feasible to invest in an increase of the dimensions of this fluxing bath due to the decrease in galvanizing work.
Additional technical manpower input

It is not clear what the trainee meant by this option. The manager is a chemical engineer and is member of the British Galvanizing Association and the American Galvanizing Association. Materials from these associations give this manager knowledge about new developments within the galvanizing process.

After tomorrow's options

Floor should be made chemical proof

According to the manager, the trainee has not been aware that the floor in the cleaning section actually is chemical proof, since it is made of asphalt.

Table 2 and 3 show classification scheme for the environmental impact of cleaner production measures.
As it can be seen in Table 2 regarding cleaner production measures and material and/or energy efficiency improvement
between 20 and 50% reduction of the volume of the target waste and between 10 and 25% improvement of the efficiency of use of the target input have been achieved respectively.

5. Analysis of the Implementation of Cleaner Production

5.1 Evaluation of Short and Long Term Impacts
The evaluation of short and term indicators are the impact of participation in CEPITA project on the AGACO's overall performance (rated as 'practical value') as well as the further development of its management and information system (rated as 'systemic impact') and the selection and management of its plant equipment (rated as 'technical impact).

5.1.1 Practical Value

Table 4 shows classification scheme for practical value. According to the table the evaluation criteria is based on implementation status, economic impact and environmental impact of the company. Implementation status is significant as the share of implemented options on total of CP options is less than 25%. Overall pay back period for all CP measures as economic impact is large since they are mostly to-day's options with immediate results. Environmental impact of CP measures is significant

5.1.2 Technical Impact

Table 5 shows environmental improvements and environmental innovations of AGACO. Most of implemented options can be categorized to as environmental improvement. There are a few number of the options which can categorized to as environmental innovation.

5.1.3 Systemic Impact

Table 6 depicts indicators for progress in implementation of environmental management practices conducive to uptake cleaner production.

The systemic impact is rated law as the company has not implemented at least 1 of these practices.

5.2 Overall Environmental Assessment of the Implementation of Cleaner Production

The understanding of cleaner production in AGACO is line with the international concept of cleaner production. However, the cleaner production concept has not yet interact with the organizational, technological, economic development, social and cultural in the company. The company has not integrated cleaner production and end-of-pipe management of wastes and emissions. Environmental management is not considerate as a tool for planning and technological development in the company. The implementation of cleaner production to-day options have shown a positive impact on the economic performance AGACO. The company has not considered environmental impact at national and global level and in other parts of the product of the company.

Employees had not played a role in the implementation of cleaner production. The management which is formed of the three major shareholders has not enthusiastic accepted the CP concept and thus they have not committed to support the trainee who had left the company during the implementation of CP. The trainee could not transfer know-how on CP to the employees as there was no formal on-job training and participation in planning and implementation of CP. There has not been language problems in relation to the involvement of the employees. The technical manager was actively involved in the CEPITA project and has supported the CP implementation.

The company doesn't have procedure for material accounting. The procedure was proposed by the trainee but it was never implemented. Quality assurance has not been formulated by the company.

5.3 Product Network

The major suppliers are power and water authorities and those who supplies chemicals like hydrochloric acid, sodium hydroxide, etc. The major customers are whole and retail dealers, the power authority, individual farmers, etc.

AGACO is not involved in the product network which has not played any role in the implementation of CP in the company. This is because the company is small and owned by three equal shareholders with different professional background.

Important topics in relation to customers are price, quality and reliability. These aspects have no any impact on the implementation of CP.

The weakness of the company in relation to customers are high price and not competitive product regarding to quality, reliability and durability. AGACO has no strengths in relation to customers and suppliers as there is a very little market of the company's products.

It is seen some branch specific conditions for cleaner production.

5.4 Knowledge Network

The suppliers and customers have not been involved in the implementation of the cleaner production. However, CEPITA consultants were actively involved in the process of CP implementation and training of the company's staff.

5.5 Regulatory Network

The public regulation at national and local level has not had impact on the cleaner production in the company. AGACO is a small company which is not targeted by the environmental regulations as the regulation bodies are more concerned with big industries.

5.6 Local Network

The local community has not influenced in the planning and implementation of cleaner production in the company. There has never been demands from the local community or the local authority for minimization of the environmental impact of the company. The employees do not come from the local community, i.e. Anger LTD area. AGACO doesn't provide social and health services to the local community.

6. Conclusions and Recommendations

ANNEX 4

CEPITA EVALUATION REPORT

Company: Lake Soap Industries Ltd., MWANZA

Contact Person: Mr. Bob, Production Manager

1. Introduction to the Company

Lake Soap Industries Ltd. is a soap manufacturing unit situated at Mwanza South. The company still continues with the manufacturing of soap products laundry and toilet soaps.

The unit operation is divided into three sections

* Steam and raw material preparation
* Saponification reaction
* Finishing

At Lake Soap laundry soap is symbolized by batchwire while toilet soap which must be full boiled requires to have brine washed and water to remove excess alkalinity, colouring impurities, brine, etc. Most of the fat, fatty acid and industrial grade caustic soda, chemicals are imported. Only packing material is locally purchased.

The former owner of Lake Soap had welcome the idea of cleaner production and it was the top management's wish to have appropriate cleaner production technologies incorporated in the soap manufacturing process. The company is now owned by two businessmen from Mwanza.

2. Participation in the CEPITA Project

Lake Soap was selected to participate in the CEPITA project between 1994-95. The former management of the company has welcome the idea of cleaner production and it was the management wish to have appropriate cleaner technologies incorporated in the soap manufacturing process. Mr. Pithaparwala, the production manager was recruited to attend CEPITA training and workshop sessions.

Waste minimization auditing was performed in line with the guide lines obtained from the CEPITA project. Most of the quantification of wastes was done based on plant operation records, purchase and material consumption records. All streams were quantified through the trainee experience, observations and records. Water consumption records was done through capacity of pump and number of hours used. Lake Soap utilize major quantity for cooling vacuum system without contamination to separately returned back to source of water. To reduce partly recycling of water was started.

A total number of 20 cleaner production options were generated during the CEPITA project. Our of which 18 were for to-day (less than few weeks) that is immediate implementation and remaining 5 for to-morrow and 5 for after to-morrow. An action plan was made for the 20 options.

3. The overall development in the company after the end of the CEPITA project

3.1 Significant changes in company

Mr. S. A. Pithaparwala who participated in the CEPITA project had left the Company since 1996 after the CEPITA project wound up its activities in 1995. His job/activities has been taken over by a new Production Manager who was an engineer by training during the CEPITA implementation period. The task force which was formerly established is no longer in place.

The former management had welcome the idea of cleaner production and it was the top management's wish to have appropriate cleaner technologies incorporated in the soap manufacturing process. The company is now owned by two businessmen in Mwanza

The new management has shown willingness and accepted the concept of cleaner production and environmental protection and is willing to give assistance as long as it does not affect regular production and does not cost extra expenditure of huge amount
The new production manager was aware of the CEPITA project and has been responsible for environmental protection. The CEPITA trainee did not leave any training manuals, reports and CP action plan to the new production manager.

No change of technology has taken for the last two decades.

3.2 Overall description of the implementation of cleaner production

PROGRESS IN IMPLEMENTATION OF OPTIONS

VASTE MINIMIZATION OPTION	IMPLEMENT-ATION STATUS	ECONOMIC BENEFITS INVESTMENT COST	NET SAVING	ENVIRONMENTAL BENEFITS QUANTITA-TIVE	QUALIT
TODAY & TOMORROW					
. Good Housekeeping	Implemented			Material Saving	High
.. Installation of new steam traps	Implemented	Tshs.147,000	Tshs.105,000	Energy	High
. Replacement of heat exchangers	Implemented	TShs.787,500	Tshs.145,500	Energy	High
. Repairing of shaft of caustic soda pamp	Implemented	Tshs.100,000	Tshs.100,000	Material Saving	High
. Repairing of shaft of reaction pump of continuos aponification plant	Implemented	Tshs.200,000	Tshs.200,000	Less waste	
. Replacement of new ring on cylinders head of vacuum pump	Implemented			Energy	High
AFTER TOMORROW					
. Replacement of old Vacuum pump with new one.	Not implemented				
.. New soap boiling crutcher with high speed agitator	Not implemented				

. Glycerin recovery plant	Not Implemented				

4.0 Analysis of the options in the action plan and new CP options developed since the project

4.1 Options developed during the project

4.1.1 Implemented Options

A lot of change look place particularly in repair-work and replacement of new parts. The economic aspect was the major basis for the implementation of the options and net was the environmental aspect.

4.1.2 No options were developed since CEPITA

4.1.3 For not-implemented options:

The management still considering to invest in the implementation of the after tomorrow options. This is basically due to the fact of costs involved.

5. Analysis of the Implementation of Cleaner Production

5.1 Evaluation of short and long term impact

The evaluation of short and term indicators are the impact of participation in the CEPITA project on the Lake Soap's overall performance (rated as 'practical value') as well as the further development of its management and information system (rated as 'systemic impact') and the selection and management of its plant equipment (rated as 'technical impact').

5.1.1 Practical Value

Table 4 shows classification scheme for practical value. According to the table evaluation criteria is based on implementation status, economic impact and environmental impact of the company. Implementation status is large as the share of implemented options on the total of CP options are more than 25%. Overall pay back period for all CP measures as a economic impact is significant since they are mostly to-day's options with immediate results. Environmental impact of the CP measures is significant.

5.1.2 Technical Impact

Table 5 shows environmental improvements and environmental innovations of Lake Soap. Most of the implemented options can be categorized to as environmental improvement. There are a few number of the options which can categorized to as environmental innovation.

5.1.3 Systemic Impact

Table 6 shows indicators for progress in implementation of environmental management practices conducive to uptake cleaner production. The systemic impact is rated significant as the company has implemented at least two of these practices.

5.2 Overall environmental assessment of the implementation of cleaner production

The understanding of cleaner production in Lake Soap is in line with the international concept of cleaner production. However, the cleaner production concept has not yet integrated with the organizational, technological, economic development, social and cultural in the company. The company has integrated cleaner production and end-of-pipe management of wastes and emissions. Environmental management is not considered as a tool for planning and technological development in Lake Soap.

The implementation of cleaner production to-days and to-morrows options have not shown a positive impact on the economic performance. The operating cost of the company is still very high. The company has not yet considered environmental impact at national and global level and in other parts of the products.

Employees have not played any role in the implementation of cleaner production. The new management is aware of environmental problems and has supported the new production manager with environmental protections measures like waste water quality monitoring, improvement of working environment, end-of-pipe management of wastes. The trainee did not transfer know-how on CP. to the production manager and the management. Therefore, the new management and production manager could not implement the cleaner production options proposed in the action plan. Language has not been a problem in relation to the involvement of the employees.

The company doesn't have a procedure for material accounting. Waste and material audits were proposed by the trainee but it was never implemented after he left the company. Quality assurance has not been formulated by the champagne and the management is not aware of the ISO 9000 and 14000.

5.3 Product Network

The major suppliers are chemical companies from UK and Singapore which supply caustic soda, fatty acid, etc. The major customers are whole and retail shops in Lake Zone.

Lake Soap has been involved in the product network in the implementation of CP in the company. The company can influence chemical suppliers.

Important topics in relation to customers are price and reliability which have no any impact on the implementation of cleaner production. The weakness of the company in relation to customers is the quality of the soap which is grade two. Lake Soap has no strength in relation to customers and suppliers as the littler interaction with them. There has not been branch specific conditions for the implementation of cleaner production in the company.

5.4 Knowledge Network

The suppliers and customers have not been involved in the implementation of the cleaner production. The company knowledge networking has been through the CEPITA project. The new production manager is also reading journals and has up to date information on soap technology development.

5.5 Regulatory Network

The public regulation at national and levels have had impact on the environmental protection in the company. The National Environmental Management Council and the Mwanza Municipal Council have been carrying out consultation with the company in order to improve its environmental management. The water quality section of Maji - Mwanza is assisting the company in waste water quality monitoring.

5.6 Local Network

The local community has not influenced in the planning and implementation of cleaner production in the company. There has never been demands from the local community. The company does closely work with a NGO - Lake Victoria Environmental Sanitation Organization in Mwanza. The employees do not come from the local area. Lake Soap is not providing social and health services to the local community.

6. Conclusions and Recommendations

ANNEX 5

Resumé of the implementation of cleaner production in Bonite Bottlers, Moshi

The following is based on the information during the visit to the plant 26 May 1998, combined with information from the documents written by Mr. Babu during and the CEPITA project. In the following paragraphs the obtained information is presented together with some questions concerning need for further and up-dated information., in order to write the evaluation report concerning the implementation of cleaner production in Bonite Bottlers.

The paragraphs are structured according to the options presented in the Working Report from November 1994.

Today's options

5.3.1 Off loading losses

According to the report from November 1994, these losses had been reduced with 90 %. How is the situation today ? Are these losses still monitored ?

Materials transfer losses

According to the report from November 1994, these losses had been reduced with 50 %. How is the situation today ? Are these losses still monitored ?

Warehousing losses

According to the report from November 1994, these losses had been reduced with 100%. How is the situation to day ? Are these losses still monitored ?

5.3.2 Sugar losses

According to the report from November 1994, these losses had been reduced with 58 %. How is the situation to day ? Are these losses still monitored ? Lost sugar is collected and exchanged for new sugar, at the ratio of 1:2. Around one bag of 50 kg is collected per month.

As one of the ISO 9002 performance indicators, the sugar yield is being calculated. It was around 98.5 % during the end of 1997 and the beginning of 1998. This indicator, however, does not seem to calculate off loading losses and other losses before the manufacturing process. Is that correctly understood ?

Filter aid usage

According to the report from November 1994, these losses had been reduced with 33 %. This usage seems to be monitored through registration on Waste assessment report forms to day. According to sheets from Spring 1998, the usage is now only reduced with 20-25%.

Water consumption

According to the report from November 1994, the water consumption had been reduced with 51 m3 pr month, which was around 1 % of the water consumption (besides the water used in the beverages), since the daily effluents at that time was around 158 m3. How was the improvement achieved at that time ?
This usage seems to be monitored through registration on Waste assessment report forms to day. According to sheets from Spring 1998, the usage is now reduced with around 36 %, compared with 1994/95. How has this major improvement since 1994 been obtained ?

5.3.4 Chain lubricant usage

According to the report from November 1994, the consumption had been reduced by 5.4 tonnes pr year, which is around 64 %. This has been achieved by supplying diluted lubricant in stead of concentrated lubricant to the operators working at conveyor belts. How is the situation to day ? Is the consumption still monitored ?

Product rejects

Two more inspectors are now located at the bottling line in order to help minimising product rejects and to find overfilled, underfilled and "dead" bottles at the bottling line in order to avoid this to go out of the plant. Is that correctly understood ?

As one of the ISO 9002 performance indicators, the product loss is being calculated. It was 0.32 % and 0.40 % during the end of 1997 and the beginning of 1998. How is this indicator being calculated ? Is it related to environmental concern also ?

Running water

According to the report from November 1994, the consumption of running water, has been minimised by installing selfclosing valves on hoses. How is this option related to the water consumption option described as part of paragraph 5.3.2 ?

5.3.5 Leaking oil pipes

According to the report from November 1994, leaking oil pipes have been tightened and fixed. How much oil seem to be saved due to this ? A weekly maintenance schedule has been set up and workers supervising a certain area is supposed to ask for maintenance, when a problem is observed. The person, who makes the repair is supposed to check that the problem really has been solved. Are these measures working ? Are leaking oil pipes being monitored as part of the internal audits ?

5.3.6 Bulk oil offloading losses

According to the report from November 1994, this problem was eliminated by using a standard hose that fits on all trucks. Furthermore, buckets are placed under the hoses during offloading in order to capture spillages that might occur. Are there any measuring of these losses ? Are they still around nil ?

5.3.7 Cleaning agents

A centralised storage has been organised. The syrup mixer operator oversees the taking of cleaning agents and forms have to be filled in. Are the actual consumption being calculated ? How much has the consumption decreased ?

Caustic soda usage

The usage was reduced with 17% (350 kg per month) in 1994 by repairing leaking tubes in the washing machine and balancing the spraying pressures at the two parts of the washer. It is said in the report from November 1994 that the daily quantity of NaOH in the effluents was 31.7 kg. According to the report the daily effluent was 158.3 m3, which with a ratio of beverage : effluent of 1 : 2.2 (according to the November 1994 report) gives a daily production of 72 m3 or 72,000 litres of beverage. This gives a consumption of NaOH of around 0.45 grammes per litre beverage. How does this figure relate to the present consumption of 1.7 - 2.5 grammes of NaOH per litre of beverage, which is one of the ISO 9002 performance indicators ?

Is it possible to calculate how much the caustic consumption actually has been reduced ?

5.3.8 Refrigerant leaks

According to the November 1994 repeort, all elaks were tightened and fixed. Was there made any calculation of the actual decrease in the R12 consumption at that time ?

Later R12 has been substituted with R134, with we consider as a new Cleaner Production option that been implemented by the company. Is there any calculation of the R134 consumption today ?

5.3.9 Used vehicle oil etc. for burning in furnace

During 1994 collection of this oil for burning in the furnance was implemented, in stead letting it go to the sewer. Around 300 litres was collected per month, which seems to save around the consumption of furnance oil of around half a day every month. Is this correctly calculated by us ?

5.3.10 Car vehicle washing

In 1994 the washing schedule was done so that vehicles were washed on alternating days. This saved, together with selfclosing valves, around 300 m3 of water every month during 1994. Today all vehicles are washed every day.

Is the water consumption for vehicle washing calculated to day ?

Tomorrow's options

1. Recycle/reuse sand and carbon filters backwashing waste waters

A feasibility study of this option was done in 1994, showing an investment of around 2,700 USD and a pay back time of around 0.33 year. The option has not yet been implemented. What is the reason for this ?

2. Reuse compressors cooling waters

A feasibility study of this option was done in 1994, showing an investment of around 700 USD and a pay back time of around 3 - 4 year. The option has not yet been implemented. What is the reason for this ?

3. Offsite recycle broken bottles and cullets

The feasibility of this option has been investigated. The cullets was given to Kioo, but when Bonite Bottlers stopped buying their bottles from Kioo, due to too poor quality, Kioo found it too expensive to come and pick the cullets. The present bottle supplier in Kenya seems not to have been offered the cullets. Bonite Bottlers seems to consider to start buying biottles again from Kioo. Today the cullets are part of the solid waste from Bonite Bottlers.

4. Trap and reuse flue gas/boiler emissions to neutralise the alkaline washer waste waters

The feasibility of this option was investigated combined with option no. 6: Reuse the neutralised bottle washing effluents for lawn irrigation, toilet flushing and/or aquar culture, showing necessary investments of around 12,000 USD and a pay back time of around 4 years. The two options have not yet been implemented. Are they still seen as an possibility ?

5. Reuse CO2 plant scrubber waters to neutralise the alkaline washer waste waters

The feasibility of this option has not yet been investigated and the option has not been implemented. Is this option still seen as an possibility ?

6. Reuse the neutralised bottle washing effluents for lawn irrigation, toilet flushing and/or aquar culture

As mentioned above, this option was investigated by the cleaner production trainee in 1994.

Since then, the feasibility of waste water tretment for the whole plant has been investigated by South African consultants, showing the need for investments of around 700,000 USD. This is considered as too much by the Managing Director. On the other hand, Bonite Bottlers needs to clean their waste water in order to obtain certification in relation to the Coca Cola quality guidelines. Bonite Bottlers plans to obtain this certificate by Summer 1999. The company is therefore interested in investigated other, cheaper possibilities for waste water treatment.

Is this correctly understood ?

After tomorrow's options

1. Substitute kieselguhrs with biodegradable materials like perlite

The feasibility of this option has not yet been investigated and the option has not been implemented. Is this option still seen as an possibility ?

2. Use EEC white sugar to avoid the use of carbon in deodorisations and decolorisations

This option was implemented during 1995 (?). This has cancelled the previous usage of activated carbon and would, according to the report from November 1994, reduce the consumption of the kieselguhrs with around 80 %. Has this been achieved ? According to the Waste assessment forms of Spring 1998, the consumption of Kensil products has only been reduced with around 25 %, compared with 1994. Has the actual decrease in kieselguhr consumption been less than expected ?

3. Dewater and dry caustic settled sludge and use it for neutralising acidic soils

The feasibility of this option has not yet been investigated and the option has not been implemented. Is this option still seen as an possibility ?

4. Use a different technology for product water deaeration

The feasibility of this option has not yet been investigated and the option has not been implemented. Is this option still seen as an possibility ?

Other options

During the CEPITA project, the task force at the plant also brainstormed on possibilities for energy savings. The following options were identified:

- Warm filling of beverage

- Refixing of insulation on steam lines

- Timely shut down of power house one hour before production ends

- Decreased frequency of sterilisation of carbon filter

- Reduction of electricity consumption by putting up translucent corrugated sheets in areas with lack of sunlight.

- Decreased energy consumption due to decreased water consumption.

Apart from the carbon filter that is no longer used (?) due to the usage of white sugar, has any of these options been implemented ? What are the achievements so far ?

The electricity consumption per litre of beverage is one of the ISO 9002 performance indicators. How has this indicator developed since it was implemented ?

ANNEX 6

CLEANER PRODUCTION FOR INDUSTRIAL POLLUTION PREVENTION

REPORT ON IMPLEMENTATION OF CLEANER PRODUCTION PROGRAMME

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INTRODUCTION

In the first phase of this programme we generated CP options from the waste Streams noted in our Factory. The waste Streams and CP. options are mentioned in this report for the purpose of Comparison of Current and previous waste generation and their impact on the environment and economy.

On Implementing these CP. options we identified those which does not need any funds i.e. those which needs good house-keeping and material handling.

Secondly we improved the system for recycling the fat/oil and other materials which was being practised before the project.

Thirdly we tackled those CP. options which required funds for Implementantion.
This is seen Plastic section.

Training of the Workers and Staff started before implementing the options and it is still going on.

During your visit to various sections in the Factory you will physically note the progress of the project and the results.

Lastly,the clean Production Technologies, activities has been intergrated in our day to day activities not only for the growth of the Company but also for Keeping our Environment clean.

CLEANER PRODUCTION FOR INDUSTRIAL POLLUTION PREVENTION WASTE STREAMS NOTED IN NOVEMBER 1994.

S.N	SECTION	WASTE STREAM
I	Refinery	Soapstock of Cotton seed Waste water from the washing process Leaking water from closed circulating water for cooling process and Condensor. Waste fat/oil. Residues (Solid waste) from bleaching agents and filtration process.
II	Votator	Waste fat/oil from leakage's and handling. Waste water from cleaning . Packaging-Solid waste.
III	Oil Mill. A	Residues from filtration process of crude oil. Solid waste of meat (kernels) and foot obtained during production of crude oil.
IV	Oil Mill. B	Dust containing cotton wool during delinting, decorticating and separation of kernels from husk
V	Husk Fired Boiler	Waste cotton husks. Leakage of water from water paper and pumps Gas emission -CO2 Ashes
VI	Oil Fired Boiler	Gas emission CO2 Soot Leakage of F.O. fuel Leakage of water.
VII	Storage and Handling of Palm oil.	Leakage of Palm oil from drums.
VIII	Storage and Handling of Caustic Soda.	Leakage of Caustic Soda from drums.
IX	Storage and Handling	Other raw materials/materials
X	Plastic Division	Solid waste of PVC and HDPE & LDPE materials rejects which cannot be grinded.
XI	Oil Packing	Solid waste of packaging material Handling losses of oil during packaging.

UNIT NAME	NUMBER OF STREAMS GAS	LIQUID	SOLID
Refinery	1	2	2
Votator	-	2	1
Oil Mill A	-	1	1
Oil Mill B	-	-	1
Husk Fired Boiler	1	1	1
Oil Fired Boiler	1	2	1
Plastic Division	-	-	1
Storage and Handling of Palm oil	-	1	-
Storage and Handling of Caustic Soda	-	1	-
Storage and Handling of raw material and others.	-	1	1
Oil Packing	-	1	1

CP OPTION WHICH WERE GENERATED

	SECTION	C P. OPTION.
I	Refinery	1. Recyeling of waste fat/oil. 2. Utilisation of the closed circulating waste effectively. 3. Good maintenance procedure of pumps and pipes 4. External recyling and utilise the soapstock.
II	Votator	1. Recycling of fat/oil 2. Good practice in handling the packaging materials. 3. Good house keeping practice in packing fats.
III	Oil Mill A	1. Good house keeping practice in handling the meat (kernels) to reduce solid waste. 2. Recycling the filtration residues.
IV	OIL MILL B	1. Extraction/ Dust Collector system for dust. 2. Good housekeeping practice for reginning the linter.
V	Husk Fired Boiler	1. Proper utilisation of cotton seed husks.

		2.	Good storage of seed husks.
		3.	Good maintenanceof pumps & pipes.
VI	Oil fired Boiler	1.	Good storage and handling of FO.
		2.	Good maintenance of pumps and pipes.
VII	Storage yard for palm oil	1.	Recyling of the collected palm oil
		2.	Constructing a good unit for emptying the drums which will minimise leakage's.
VIII	Storage yard for Caustic Soda	1.	Leaking drums of caustic soda should be utilised immediately or a collector should be placed beneath.
IX	Oil Packing	1.	Good handling practice during packing oil.
		2.	Good handling practice of the packing material.
		3.	Recollecting the waste oil and recycling .
X	Plastic Division	1.	Good practice in recyling of the plastic wastes.
		2.	Good practice in material handling.

CP OPTIONS FOR EACH UNIT OPERATION

CP OPTION / UNIT NAME	GOOD HOUSE KEEPING	RECYCLING (INTERNAL)	EXTERNAL RECYLING AND UTILISE OR SALE
Refinery	2	1	1
Votator	2	1	–
OIL mill A	1	1	–
OIL Mill B	1	–	1
Oil Fired BOILER	2	–	–
Husk Fired Boiler	2	–	–
Storage & Handling of palm oil	1	1	–
Storage & Handling of Caustic soda	1	–	–
Storage & Handling of other materials	1	–	–
Plastic Division	1	1	–
Oil Packing	1	1	–
TOTAL	15	6	2

TOTAL CP OPTION = 23

CP OPTION IMPLEMENTED AND THE RESULTS

SECTION	CP OPTION	IMPLEMENTATION STATUS	ECONOMIC IMPACT	ENVIRONMENTAL IMPACT
REFINERY	External recycling and utilise the soapstock	Other users were encouraged to buy it but they have stopped. We opted to build treatment plant.	Some money will be utilised	Safe water for the beings in the lake.
	Recycling of waste fat/oil	This is done	The loss is recovered by 96%	Less contribution to the total effluents
	Good maintenance procedure for pumps paper and other oil transportation means.	This is done	Minimised losses	Less contribution in total effluents
	Utilisation of the closed circulating water for condenser and cooling effectively.	No water is escaping from closed circulating water system	Less consumption of water	Less waste water into the lake.
VOTATOR	Recycling of fat / oil	It is being done.	The loss is recovered	Good working environment the worke
	Good practice in handling the packaging material.	It is being done.	Reduction in ordering the material.	Less contribution in the total environment.
	Good house keeping practice in packing cooking fat.	It is being done.	Less spoiled fat / boxes.	Solid waste have been reduced.
OIL MILL A.	Proper utilisation of Meat (material hand-ling)	It is being done.	Less spoiled meat is disposed High yield of Crude oil.	Solid waste have been reduced.
OIL MILL B.	Dust collector system for removing the dust	Not implemented.	-	-
HUSK FIRED BOILER	Proper utilisation of cotton seed husks.	Other users of seed husks were encouraged to take free.	No disposing cost (saving)	No smoke from the burning the husks in our compound, which was disturbin our neighbours.
	Good storage of seed husks.	The rest were utilised effectively to our internal needs of the Boiler furnace.	The Oil fired Boiler is not used FO could have been purchased This is a cost.	The compound which we were using to dispose grasses are now growing.

	Good maintenance of pumps & pipes(water)	Proper maintenance is carried over	Reduction in water consumption.	Less water let into the sewage.
OIL FIRED BOILER	Good storage and handling of FO.	The boiler is not utilised - see the above.	No cost for purchasing FO. Consumption is 2,500 Lts/day	No enemies originating from burning the FO. Remission.
	Good maintenance of FO pipes, + pump.	_ do _	No loss	No contribution of FO in the effluents.
	Good maintenance of water pipes, + pump.	_ do _	No loss	No contribution of water in the effluen
STORAGE YARD FOR PALM OIL	Recycling of the collected palm oil.	Is done.	The loss is recovered by 96%	Reduced the % of fat in the effluents.
	Constructing a good unit for emptying the drums which will minimise leakage's.	We changed to other place which is very suitable for empty-ing the drums.	The loss is recovered by 96%	Reduced the % of fat in the effluents.
STORAGE YARD FOR CAUSTIC SODA	Leaking drums should be utilised immedia ely or a collector should be placed beneat	The supplier has improved, by supplying us caustic with good quality of packaging.	Minimised the losses by utilise the material by 96%.	Less caustic content in the waste water.
OIL PACKING	Good handling practice during packing the oil.	This done.	Less oil is spoiled Less spillage.	Working environment is good.
	Good handling practice for the packing material.	This done.	Less rejects are relvatised.	Solid waste has been minimised.
	Collecting the waste oil and recycling.	This done.	The loss is recovered.	
PLASTIC DIVISION	Good practice in material handling.	This done.	Raw material were utilised near 100%.	No raw material can be seen in our area, even the surroundings.
	Good practice in recycling plastic wastes.	A slicing M/C was introduced t slice the rejects so that Grindi M/C can grind it easily.	Recycling was improved by 96%.	Less less rejects are thrown away.