

ADVANCED CLEANER PRODUCTION TECHNOLOGIES

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Executive Summary

Environmental responsibility is, and will be, a key driver of sustainable development and international trade. Industry needs to align itself proactively to support this by understanding and adopting *cleaner production technologies*. The development of cleaner production technologies requires a greater understanding of the environmental linkages to manufacturing processes, products and services, as well as a culture that encompasses waste minimisation. Cleaner production ensures sustainable use of natural resources by minimising negative environmental impacts. Cleaner production will benefit South African industry by driving operational costs down, reducing the costs of environmental impacts, and increasing the competitiveness and acceptance of South African manufactured goods in international markets.

Five sectors have been identified for the development of cleaner production technologies in the National Advanced Manufacturing and Logistics Technology Strategy. These are the cultural, automotive, metal, textile, and chemical sectors. Cleaner production technologies will be used to improve manufacturing efficiency and reduce environmental impacts. Improvements in the design and operations of products, processes and services will be identified, evaluated and implemented. The most commonly used assessment tools are: Process Efficiency Audits (energy, water, and materials), Environmental Impact Assessments and Environmental Life-cycle Analyses.

South Africa currently has a low level of awareness of environmental impacts and there is little knowledge of the economic benefits of cleaner production in most industry sectors and government. Hence, any future strategy should focus in the short term on creating awareness, education on the benefits of improved manufacturing operations, and the enforcement of environmental legislation, with clearly articulated incentives.

In the medium term, the strategy should focus on the benefits of process improvements and innovation resulting from R&D and training. Over the longer term, the focus should be on creating a sustainable industry through the adoption of cleaner production as a value system. A dedicated National Cleaner Production Technology Research Mission is required in these sectors to drive the development of cleaner technology if cleaner production is to become standard business practice. This requires strong partnerships between industry, government, tertiary institutions, and science councils.

Abbreviations

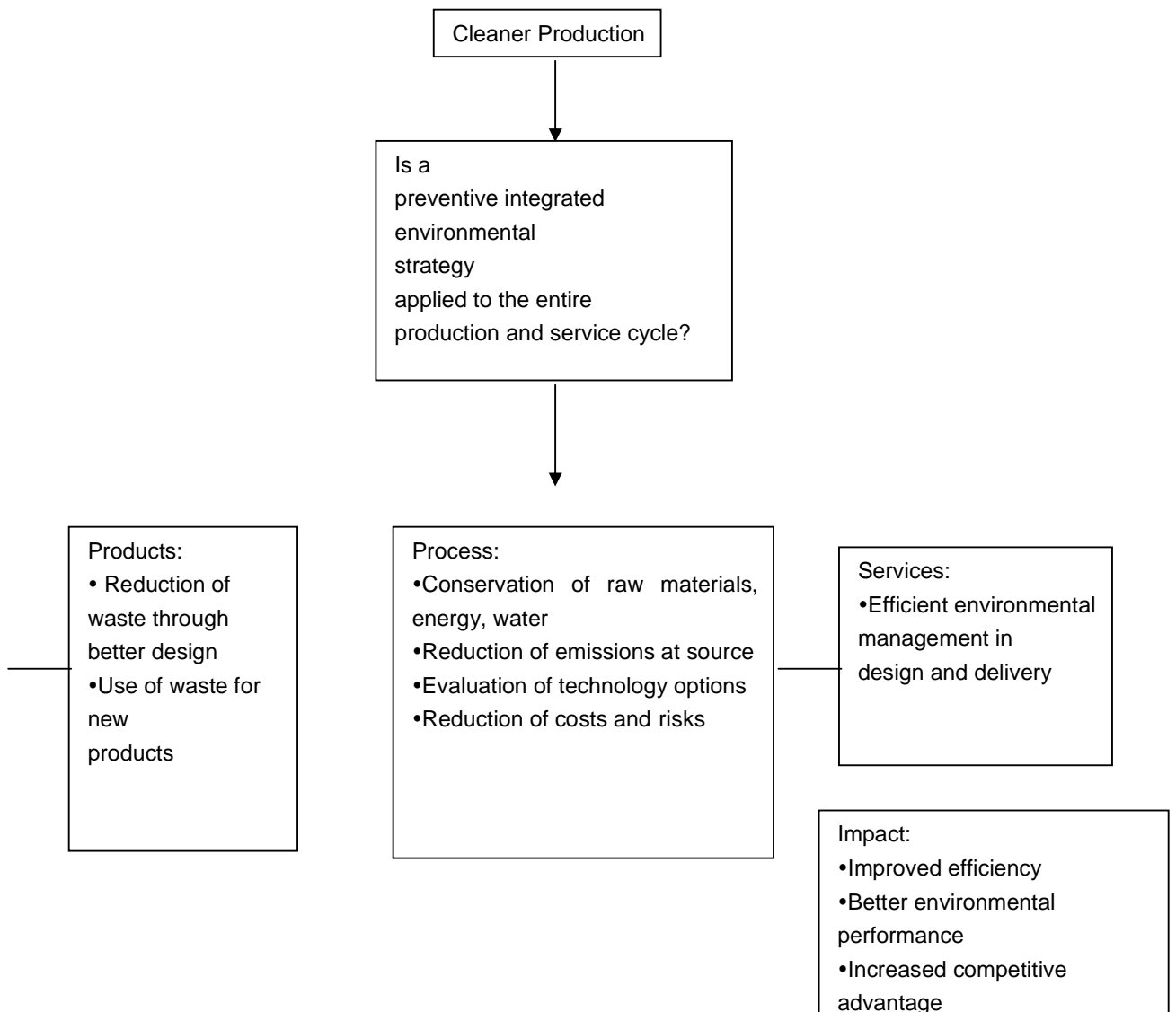
AGOA	Africa Growth and Opportunities Act
CP	Cleaner Production
DANCED	Danish Cooperation for Environment and Development
DEAT	Department of Environmental Affairs and Tourism
diti	Department of Trade and Industry
EUA	European Union Act
ICPIC	International Cleaner Production Information Clearinghouse
ILO	International Labor Organization
SMMEs	Small, Medium and Micro Enterprises
NCPC	National Cleaner Production Centre
NGO	Non-Governmental Organisation
OEM	Original Equipment Manufacturers
UN	United Nations
UNEP	United Nations Environmental Programme
UNIDO	United Nations Industrial Development Organization
WRC	Water Research Commission

1. Introduction

Global commitment to protect environmental degradation and maintain sustainable development still lags behind economic and social development. More efficient, fair and responsible use of natural resources and change towards more sustainable patterns of consumption are needed.

This report discusses the need for and makes recommendations for initiating cleaner production (CP) in enhancing sustainable development and competitiveness in the South African manufacturing industry through: (a) building national capacity in cleaner production, (b) the transfer and development of environmentally sound technologies, and (c) fostering dialogue between industry and government. The market sectors being assessed are: textiles and clothing, automotive, metals and minerals, crafts and culture, and chemicals.

Industrial activities are a major source of environmental problems and account for approximately one-third of the generation of greenhouse gas emissions and a large percentage of the hazardous waste generation. Until the early 1990s, global environmental protection strategies were focused on “end-of-pipe” methodologies, focusing on waste minimisation. However, it is now widely accepted that a preventive approach would offer a long-term and sustainable solution. CP and sustainable consumption are integrated and are able to offer a clean environment and sustainable development for current and future generations. CP is one of the UN service modules towards sustainable industrial development and competitiveness. This focus received significant support from the conference on Ecologically Sustainable Industrial Development (ESID 1991) and at the recent World Summit held in South Africa (paragraph 107, 2002). Experience shows that the application of CP can significantly improve the competitiveness of industry and reduce the negative environmental impact of processes, products and services alike, due to the efficient use of water, energy and raw materials. A schematic process diagram of CP methodology is presented below.



2. Definition and Scope

Cleaner production (CP) is the continuous application of an integrated preventive environmental strategy to processes, products and services to increase eco-efficiency and reduce risks to humans and the environment.

Production process: Conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity of toxicity of all emissions and wastes at the source.

Products: Reducing negative impacts over the entire life-cycle of a product, from design to ultimate disposal.

Services: Incorporating environmental concerns into designing and delivering services (UNEP, 1989).

The concept of CP includes the emphasis on continuous improvement of environmental performance, through an elaborate procedure of review and innovation built into the assessment process. Technology improvements may be accomplished through:

- Redesigning of existing products and services.
- Modification or upgrading of existing equipment and processes.
- Acquisition of new equipment, processes and product lines.
- Adoption of the best available techniques (BAT).

Typical scopes for saving:

- Raw materials 1 - 5%
- Packaging 10 - 90%
- Consumables 10 - 30%
- Ancillary materials 5 - 20%
- Electricity 5 - 20%
- Water 20 - 80%
- Effluent 20 - 80%
- Solid waste 10 - 50%

3. Global CP Technology Trends

Since 1989, the United Nations agencies, UNEP and UNIDO, have promoted the concept of CP and established several National Cleaner Production Centres throughout the world, in Africa, Asia, Latin America and former Eastern European countries. To foster commitment to CP, the UN World Summit 2002 also endorsed the concept of CP in strengthening industrial competitiveness and reducing negative environmental impacts. The International Cleaner Production Information Clearinghouse (ICPIC) is an information database providing examples of technical, policy applications, and contact information of expert institutions. With the support of the Norwegian government, ILO promotes Cleaner Production and better environmental performance in industry.

Economic globalisation has led to increased industrial and economic competition. Intense pressure is now placed on companies to be adaptable, innovative and fast. Rapid technological advancements and the anticipation of new opportunities and threats have also intensified the search for suitable tools to answer these challenges. Consequently, CP has received growing attention in various national and international forums. The discussion has been particularly lively in the developed countries where CP is seen as an important tool for developing competitiveness and sustainable strategies for economic growth. Experience in other countries shows that as global economic forces come into play, consumers, especially in the developed countries, will demand environmentally friendly goods and the local public as well will take greater interest in local, regional and international environmental issues. International traders are increasingly demanding improved product quality while reducing energy, raw materials and water consumption, and minimising undesirable emissions. Life-cycle analysis along the entire value chain of a process, product or service can assist in identifying key areas for interventions to promote eco-efficiency and responsible environmental management.

4. Current State of CP in South Africa

In South Africa, legislation relating to the environmental impact from industrial activities is provided for in the national and local government spheres by the Constitution, the National Water Act (NWA), the National Environmental Management Act (NEMA), the White Paper on Integrated Pollution and Waste Management, and the National Waste Management Strategy. This determines the strategies towards adopting cleaner production. The White Paper on Integrated Pollution and Waste Management, and the National Waste Management Strategy identify cleaner production and waste minimisation as two of the environmental priorities in South Africa. It is the desire of the South African government to develop and promote a clean industry with efficient use of energy and raw materials and with limited generation of waste and pollution.

In support of this, the Department of Trade and Industry (**dti**) and the Department of Environmental Affairs and Tourism (DEAT), with the assistance of the Danish government (DANCED), has formulated a programme of assistance to CP in South Africa. The approach is to support identified industrial sectors through capacity-building, practical demonstration and dissemination of CP information. With the assistance of the Norwegian government, the DEAT has plans to implement a CP programme, possibly in the pulp and paper or food industry. Carl Duisberg Gesellschaft eV. (CDG) of Germany, an NGO, has conducted a training programme for local consultants and representatives from public institutions to enable them to plan and implement sustainable environment projects. The following paragraphs highlight some of the CP achievements attained and activities taking place in South Africa.

The Textiles Directorate of the **dti**, together with the Textile Federation and other stakeholders, is currently developing a strategy to increase competitiveness and sustainability in the sector, which is underpinned by the principles of CP.

A **dti**/UNIDO-supported National Cleaner Production Centre (NCPC) has recently been established at the CSIR with a budget of approximately R19 million over a three-year period. The NCPC will establish an active network with different industry sectors, national institutes, government departments, regional partners, tertiary institutions and NGOs. The activities of the NCPC will focus on the entire production cycle, foster the efficient utilisation of waste to design and produce innovative, and environmentally and economically sound, technologies and

products. Based on the specific needs of the industry sector, the NCPC will customise and deliver a wide range of services, including information dissemination; identify and formulate potential CP investment projects; undertake in-plant assessments or demonstrations; provide training; and give policy advice. In the beginning, the NCPC will be focusing on three sectors: textiles and clothing, food processing, and chemicals. Over time, the activities will extend into other sectors of the manufacturing industry. The focus of the activities will be directed at SMMEs, which normally have limited resources for implementing environmental protection programmes or are quite naïve about them. The establishment of a National Cleaner Production Centre represents a major turning point in CP activities in South Africa. It is expected that after three to five years, the concept of CP will have become entrenched in many industry sectors.

DANCED has run CP projects in fishing, metal finishing and textile industries over the past five years on a budget of over R60 million. Together, these projects involved 20 demonstration projects, 40 detailed studies, 100 CP audits, and 40 trained CP experts. A summary of the DANCED textiles and clothing project work is given in the appendix.

Through the DANCED project, for the first time a South African company has produced eco-friendly cotton, giving it access to new markets. There has been remarkable success in assimilating CP principles through waste minimisation clubs in the Durban area (KZN) and Cape Town (Western Cape) in the metal finishing, textiles and fishing sectors. For instance, the Hammersdale Club has reported savings in the order of R4 million per year, with a potential further R14 million per year identified.

According to the Textile and Clothing Federation, CP has the potential to save the industry over R600 million per annum. The waste minimisation club concept involves a small number of companies, generally within a small specified geographical area, working together to exchange ideas and information on waste minimisation and, in this way, encourage one another to improve process efficiency, save money and reduce their environmental impact. Having started in the Netherlands in 1990s, there are now more than 80 clubs in the UK and similar initiatives in New Zealand and India.

The Water Research Commission (WRC), together with UK Enviro March and Danish Cowi, supported by the EU Director General XVIII (Thermie), have co-funded the establishment of two waste minimisation clubs in the metal finishing

and textile manufacturing sectors. The success of these clubs has led to the formation of four more partially self-funded clubs. A strategy is being developed for the initiation and management of such clubs throughout the country.

In addition to national initiatives, there are several industry associations, as well as company-specific CP programmes currently running or planned in the country. For example, the Chamber of Mines of South Africa conducted a study of AngloCoal that examined the possibilities for improving the company's extraction efficiency, separation techniques and combustion technologies, waste disposal practices, water use, with mine water used to irrigate crops. The Plastics Federation, and the Chemical and Allied Industry Association (CAIA) have also embraced the concept of cleaner production. BMW South Africa and Sasol have very strong CP programmes running.

5. Market Sector-Specific CP Needs

Industrial enterprises in South Africa will be progressively under pressure to meet the challenges of quality and environmental excellence because their major trading partners from the developed countries are giving more importance to environmental requirements. In this respect, CP is perceived as the preferred option for meet the challenges of competitiveness and environmental protection.

The listing of South African companies on the London and New York stock exchanges has led to increasing awareness of environmental issues and the promotion of CP. Export-oriented companies are realising the need for environmental reporting and are among the leaders in the promotion of CP. Although responsible companies are already advanced in implementing CP measures, it is evident that all companies no longer have a choice about whether or not to consider environmental issues in their business strategies.

5.1. Textiles and clothing

The textile industry is South Africa's sixth largest employer in the manufacturing sector and the eleventh largest exporter of manufactured goods. In recent years, the industry has experienced negligible growth due to poor local consumption and low-priced imports. In 1995, a long-term strategy for the industry entailing a phase-down of tariffs up to 2002 was implemented. The Africa Growth and

Opportunity Act (AGOA) and the EU Agreement (EUA) trade agreements hold great promise for the industry.

In the textile industry there is reasonably high awareness of environmental issues, but environmental demands from overseas customers are low and the industry is concerned primarily with legal compliance. However, the industry expects these demands to increase in future. Farmers and manufactures of textiles have a great interest in implementing CP measures. Awareness among and environmental demands from South African consumers is very low, in view of the more pressing issues of unemployment and poverty.

In the clothing industry, general awareness of CP, environmental management systems and eco-labelling is low, whereas awareness is higher among the industries and organisations located closer to the start of the fibre producers and textile manufacturers. Very few companies have implemented any form of environmental procedure in their operations, with the exception of those that have begun implementing waste minimisation, and effluent treatment and reduction. It is interesting to note that there is a general lack of willingness to adopt environmental protection initiatives due to the perceived costs and the lack of pressure from the manufacturers or from the end-users.

The sector requires CP technologies and environmental awareness from the agricultural input stage (pesticide- and fertiliser-free wool and cotton) through to environmental stewardship covering CP initiatives such as waste minimisation, recycling, environmental audits, environmental management and eco-labelling, standards and certification schemes, and the marketing of environmentally friendly textiles. The challenge will be to build on existing awareness established through DANCED projects and to provide support to government on the need for enforcing environmental protection legislation, eco-labelling for export markets, and savings to industry from the adoption of new CP technologies.

5.2. Automotive

The automotive industry is the third largest sector in the South African economy, and vehicle production represents about 80% of Africa's output. The market can be divided into two groups, the Original Equipment Manufacturers (OEM) and the component suppliers to the OEMs. OEMs are affiliated to or are subsidiaries of international mother companies and have environmental management systems in place – in some cases even a CP programme. The component suppliers are

further subdivided into the main suppliers and secondary suppliers. The main component suppliers are usually 100% local companies, although a few have international links. In this group of main component suppliers, environmental impact awareness varies widely, from no knowledge within local companies to full knowledge for those with international ties. Secondary component suppliers are generally very naïve about environmental impacts.

The integration of the industry into global supply chains places demands on the industry that were not previously considered as priority issues. As an international norm and because of export markets, OEMs are increasingly demanding compliance with environmental regulations from the main component suppliers. The new South African legislation compels the industry to disclose information pertaining to environmental impacts when required. However, in the pre-manufacturing stages, environmental impact information is either unknown or inaccurate and there is general reluctance to supply the data. Local assemblers are therefore highly uncertain about the environmental claims that can be made on the South African exported models when considering the full automotive manufacturing supply chain. The implementation of a CP programme will remove this uncertainty to the benefit of the sector. The continued competitiveness of the industry will therefore require a focus on CP technologies throughout the life-cycle, including the post-manufacturing stages, such as the efficiency of fuel consumption and related emissions.

Although most of the raw materials, ranging from metals and glass to plastics, can be recycled, reused or recovered, a large proportion, including the residue from car shredders, finds its way into landfills as waste. This solution is neither desirable nor sustainable, despite the large availability of empty land for landfill sites in South Africa. The major environmental impact problems in the sector are due to the component manufacturing processes, such as effluent containing heavy metals, and waste from paint, solvents, oils, greases, tyres and non-recyclable components.

The best approach here would be to establish environmental management systems, first with the main component manufacturers, and then later to focus on the secondary component suppliers. For instance, there has been good progress in the Rosslyn industrial area where BMW South Africa is playing a pivotal role in raising environmental impact awareness by setting up an Environmental Forum.

5.3. Cultural and crafts

The cultural and crafts industry is not easily quantifiable. The sector covers a very wide range of disciplines, which includes the full value chain from individual crafters, NGOs and government programmes for poverty alleviation, to the international arena.

This sector is dominated by small-scale manufacturing and in many cases by individual households. Awareness training in CP within the sector is required, with the goal of sustaining natural resources, protecting biodiversity, conserving water and energy, reducing the human health risks of toxic chemicals, reducing waste and pollution, and achieving financial savings.

5.4. Metals

The metals industry could be divided into two categories, namely a materials classification of carbon steel, stainless steel and light metals, and also in terms of the materials value chain as the primary producer for component manufacture. The industry, especially the processing sector, covers a very wide range: from automotive, coating and packaging, to aerospace and microelectronics. The types of process range from melting and solidification, rolling or stamping, to coating production by thermal spray and electrodeposition.

Traditionally, South Africa has been at the primary end of the supply of minerals and now there is an urgent need to produce value-added manufactured goods in order to achieve rapid economic growth. Much of this work could be expected to take place along the value chain, i.e. in the metal production, semi-processing and beneficiation processes. The future market growth and competitiveness of the metals sector is expected to be based on materials competition, substitution and integration by taking advantage of the emerging light-metal-based materials and advanced materials. Technology needs depend on the situation with regard to the value chain, with throughput and cost production forming the focus on the primary side, whereas on the downstream side the focus is on component optimisation, reliability, eco-friendliness, etc. The market is also perceived to be driven by concerns over the environmental impact of a product. Environmental concerns will foster the recognition of the applications of light metals, such as aluminium, magnesium and titanium, and a life-cycle analysis of the processes and products.

In metals production and processing, the main issues of environmental impact emanate from energy and water use, effluent and solid waste, and atmospheric pollution. In many cases, there is not so much a need for new, revolutionary technologies, but for simple changes to operating practices. The application of CP techniques in the metals value chain will be in the areas of raw materials, design and development of products and processes, design of production plants and processes, energy efficiency, and waste management and emission control.

5.5. Chemicals

The South African chemical industry constitutes 25% of manufacturing GDP, which in turn makes up 25% of the total national GDP. It is therefore an important sector and has a major impact on the overall performance of the country's economy. The total market production, including both the domestic and export markets, is valued at about US\$13 billion. However, it was substantially distorted during the years of the last regime and is having difficulty adjusting to the new global market conditions. The sector is widely fragmented, with different interests, no "common vision" or strategy. Over the years, the sector has been static (as measured by employment numbers) or has grown slowly.

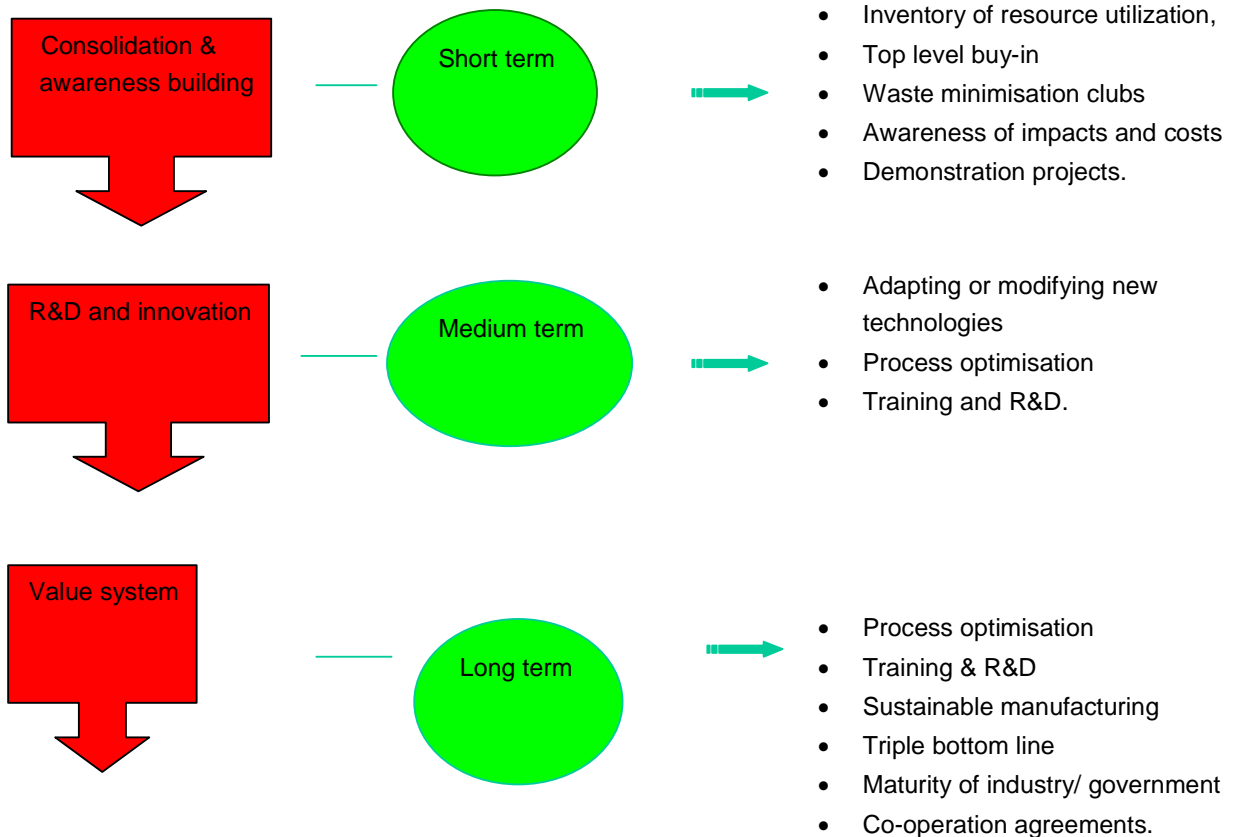
Fundamentally, there is a major problem with respect to competitiveness and innovation in the sector as global manufacturing trends are shifting to meet increasing environmental, efficiency and quality standards. Market trends are calling for customer focus and integration, and low cost and efficient production linkages are key. Future growth in the sector appears to be restricted to markets that have significant domestic potential, including China, and possibly India and Brazil.

Within the chemical sector, the sustainable production and environmental impact issues that need to be addressed include water and energy use, the toxicity of raw materials and products, solid waste production and disposal, and effluent and emission problems. CP technologies can benefit the industry by reducing the costs of related environmental impacts, drive down costs and increase the competitiveness and acceptance of South African-manufactured chemical products in the international markets.

6. Approach and Implementation

It is easy to recognise that the implementation of CP principles in South Africa differs widely, depending on the needs of a particular industry sector. In general, large industries tend to apply such technologies more than smaller industries. However, even within the large industries there are examples of significant differences with the developed world. It is also evident that different approaches are required to promote the uptake of CP, depending on the scale of the activities.

Any strategy to adopt CP principles should use a phased approach, entailing awareness and training, R&D, and lastly the adoption of CP as a value system. The details of the proposed implementation plan for the different industry sectors are given in the appendix. Based on the current CP activities in the country, it is apparent that a general implementation framework could be presented as shown below.



7. Measurement Criteria

The success indicators of implementing CP principles are not easily quantifiable. However, a measure of the success of a CP project could be determined by including the following:

- Increased value of exports.
- Number of new CP investment projects.
- Number of technology-improvement projects.
- Number of jobs created or protected.
- Number of companies supported.

8. Recommendations

A dedicated national Cleaner Production Technology Research Mission is required to drive cleaner technology development and capacity-building if CP is to become standard business practice. This requires strong partnerships between industry, government, academia and S&T institutions. In the South African context, three main instruments that can be used to assist in the uptake of CP technologies are: (1) awareness/training, (2) regulation and (3) incentives. It is envisaged that awareness and training would at happen in the government sphere and in industry, respectively. The enforcement of regulations and incentivisation are seen as the role of the government (authorities). A number of recommendations are made.

8.1. Government should

- Develop a national CP strategy that clearly underlines the political will for promoting CP, defines a vision, proposes a political framework supportive of CP, and contains a workable plan and the necessary instruments for implementing CP principles.
- Integrate CP into the national industry-upgrading programmes. This could avoid future export barriers for South African products to the markets of the developed world.

- Implement new and integrated industrial environmental regulations that reward those companies that are serious about CP.
- Include CP in the development of new instruments, such as environmental duties, subsidies, tax rebates and support programmes.
- Provide financial support and sensitise financial institutions to see investment opportunities in the implementation of CP in SMMEs.
- Urge financial institutions to integrate CP into their lending practices.
- Assign priority to CP over pollution control by phasing-out regulations that may lock industry into end-of-pipe treatment.
- Eliminate unsustainable underpricing of process water, energy (electricity to industry) and other natural resources.
- Put emphasis on creating awareness of CP at different levels in government, industry, the media and civil society.
- Promote the concept of sustainable cities programmes and waste minimisation clubs. This is one of the best ways to get the city and metropolitan councils to promote and adopt CP.
- Implement a multi-media dissemination programme demonstrating the added value of how CP supports industry upgrading and modernisation.
- Assist in adapting business and engineering education curriculums to incorporate CP.
- Assist R&D into cleaner processes, products and services.

8.2. Industry should

- Commit to top management buy-in.
- Encourage the widespread use of life-cycle assessments for processes, products and services.

- Market environmentally friendly goods.
- Support the funding of training for and implementation of CP in SMMEs.
- Adopt environmental reporting, including “green accounts” and triple bottom-line reporting.

APPENDIX 1: IMPLEMENTATION PLAN

Table 1: Implementation plan for cleaner production technology in selected South African manufacturing industries

Sector	HOWS			Achievable time-scales
	Awareness	Training	Implementation	
Crafts/cultural	<ul style="list-style-type: none"> Industry review: identify environmental impacts Raise awareness of impacts of dyes, land usage, deforestation and extinction on biodiversity. 	<ul style="list-style-type: none"> Workshops through schools forum Prepare manuals on toxicity of chemical raw materials Training on sustainable use of raw materials, water, energy, wood and fibres for craft products Use of waste materials for craft products 	<ul style="list-style-type: none"> Identify alternative manufacturing process options. Improve process efficiency by using pinch approach to water and energy usage. Research on alternative energy sources and natural dyes. Form cooperatives (waste minimisation clubs). Encourage planting of special wood species and fibres . 	<ul style="list-style-type: none"> Medium Medium to long Medium to long Short Medium to long
Automotive	<ul style="list-style-type: none"> Raise awareness of environmental impacts of supply chain components with regard to: <ul style="list-style-type: none"> wastes (paints, solvents, oils and greases, tyres, non-recyclable components) final products throughout their life-cycles supply chain processes, e.g. leather chemical treatment 	<ul style="list-style-type: none"> Run on-the-job training for suppliers using workshops through major auto manufacturers and industry associations. Develop CP manuals applicable to sub-sectors. Incorporate CP into curriculums at all levels of tertiary institutions supplying manpower. 	<ul style="list-style-type: none"> Government and industry set CP standards for manufacturing processes. Assist government to set and enforce standards that enable industry to report compliance with international standards. Assist accreditation bodies to establish technical working groups for auditing and inspection. 	<ul style="list-style-type: none"> Short Short Medium to long

HOWS				
Sector	Awareness	Training	Implementation	
			Achievable time-scales	
	<p>methods</p> <ul style="list-style-type: none"> • Raise awareness of environmental regulations of export markets. 		<ul style="list-style-type: none"> • Use international knowledge. • Adapt/ innovate manufacturing processes for the South African situation • R&D on alternatives for Cr in leather production. • R&D on alternatives to oil-based paints, e.g. water. 	<ul style="list-style-type: none"> • Medium to long • Immediate to long • Medium • Medium
Metals	<ul style="list-style-type: none"> • Raise awareness throughout industry and suppliers chain of environmental impacts of: <ul style="list-style-type: none"> • wastes (solvents, oils and greases, chemicals, effluents, emissions, non-recyclable components) • final products throughout their life-cycles. • supplier chain processes, e. g. electroplating • Raise awareness of environmental regulations of export markets. • Future of industry will include “design for the environment”, such as use of light metals and advanced materials. 	<ul style="list-style-type: none"> • Run on-the-job training for suppliers using workshops through major metal manufacturers and industry associations. • Develop CP manuals applicable to sub-sectors. • Incorporate CP into curriculums at all levels of tertiary institutions supplying manpower. 	<ul style="list-style-type: none"> • As appropriate: <ul style="list-style-type: none"> • Government and industry set CP standards for manufacturing processes. • Assist government to set and enforce standards that enable industry to report compliance with international standards. • Assist accreditation bodies to establish technical working groups for auditing and inspection. • Use international knowledge. • Adapt/ innovate manufacturing processes for the South African situation. • R&D on alternatives for highly polluting industry processes, e.g. electroplating. 	<ul style="list-style-type: none"> • Medium to long • Short • Short • Short • Short • Medium • Long

HOWS				
Sector	Awareness	Training	Implementation	Achievable time-scales
Textiles	<ul style="list-style-type: none"> • Build on existing awareness established by DANCED/dti/DEAT/WRC • Main focus: <ul style="list-style-type: none"> • on Government needs for enforcement of environmental protection legislation • on easier enforcement for government by adoption of CP measures • on importance of eco-labelling for export markets • on savings to industry from the adoption of new CP technologies. 	<ul style="list-style-type: none"> • Build capacity on training in the TEIs (Cape Town, Durban, Wits, and PE) in: <ul style="list-style-type: none"> • cleaner production processing for textiles • designing for the environment • marketing for the environment • how to use ISO 14000 in SMEs. • Build capacity in industry associations for training • Build capacity in government departments for enforcing use of CP. 	<ul style="list-style-type: none"> • R&D to adopt cleaner production products for metal processing, e.g. blowing stainless steel. • Industry to implement the chemicals score system. • Government and industry set CP standards for manufacturing processes. • R&D on waste minimisation for the textiles industry (effluents) • R&D on minimisation of raw materials (pinch for water, energy) and toxic chemicals • Regional projects to enable industry and municipalities to understand how waste disposal services are required for expansion of industry in urban areas (sustainable cities programme). • Government to introduce incentives (tax rebates, subsidies, levies) for implementation of CP. 	<ul style="list-style-type: none"> • Long • Short • Medium • Long • Short • Short • short
Chemical	<ul style="list-style-type: none"> • Build awareness of the financial and environmental benefits of CP at all levels of the chemical industry: large industries, SMMEs, 	<ul style="list-style-type: none"> • Use industry associations, professional associations, organised labour; in-house company ISO 14000 and CP 	<ul style="list-style-type: none"> • In conjunction with industry associations, implement chemical score systems. • Introduce waste minimisation clubs 	<ul style="list-style-type: none"> • Short • Short

HOWS			
Sector	Awareness	Training	Implementation
	<p>industry associations, and authorities at national, provincial and regional levels.</p> <ul style="list-style-type: none"> • Main focus on local authorities and industries in the “hot spots” in South Africa and the problems with emissions, effluents, and solid waste management. • Introduce product life-cycle thinking to product and process development, marketing and the promotion of “green chemicals”. 	<p>programmes</p> <ul style="list-style-type: none"> • Incorporate CP into engineering, financial and environmental health courses. • Use the sustainability index for company performance reporting (Dow Jones), and the triple bottom-line. • Use the cleaner development mechanisms (CDMs). 	<p>at regional and sector levels.</p> <ul style="list-style-type: none"> • Introduce CP auditing systems (raw materials, energy, water, and waste). • For bigger companies, introduce in-house process-improvement panels for CP. • “Green Network” recognition for CP adoption by industry/government association. • Carry out product LCAs for industry and government to assist in decision-making for recycling (plastics) and solid and effluent waste management.
			<p>Achievable time-scales</p> <ul style="list-style-type: none"> • Short • Medium (need standards) • Short

APPENDIX 2: SUMMARY OF DANCED PROJECTS

Waste minimisation (ref. below)	Waste minimisation consists of any activity for preventing or reducing the volume and/or environmental impact of waste that is generated, treated, stored or disposed of.
Waste minimisation club	A group of companies that share information and training on waste minimisation practices. The club is usually located in a region and based on an industry sector. For example, wine-makers in a municipality. A government department that wishes to reduce pollution in an area often funds a technical and industry specialist to establish the club.

Ref: *National Waste Management Plan*, Vol. 2, Department of Environmental Affairs and Tourism, Oct. 1999.

Green chemistry (ref. below)	The design of products or processes that reduce or eliminate the use or generation of hazardous substances.
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Ref: *USEPA Green Chemistry Fact Sheet*. EPA 742-F-02-003, March 2002.

APPENDIX 3: WASTE MINIMISATION CLUBS IN SOUTH AFRICA

Name	Place	Facilitators
KZN Metal Finishing Waste Minimisation Club (now Association)	Durban	Pollution Research Unit of the University of Natal
Hammersdale Waste Minimisation Club	Durban	Pollution Research Unit of the University of Natal
2 nd KZN Metal Finishing Waste Minimisation Club	Durban	KZN Metal Finishing Association
Gauteng Metal Finishing Waste Minimisation Club	Gauteng	Gauteng Metal Finishing Association
Cape Metal Finishing Waste Minimisation Club	Cape Town	Cape Metal Finishing Association (CMFA)
Waste Minimisation Club for Large Companies in Western Cape	Cape Town	+ BECO – Institute for Sustainable Business
The Pietermaritzburg Waste Minimisation Club (*)	Pietermaritzburg	BECO – Institute for Sustainable Business University of Natal, Chemical Technology Group
Nelson Mandela Metropole Metal Finishers Waste Minimisation Club (*)	Port Elizabeth	University of Port Elizabeth, Inst. of Environmental and Coastal Management.
Eco-club in Franschhoek (*)	Franschhoek	Enviroservices, University of Stellenbosch
City of Cape Town Waste Minimisation Club for the Plastics Industry	Cape Town	BECO – Institute for Sustainable Business
Gauteng Waste Minimisation Club for the Plastics Industry	Gauteng	BECO – Institute for Sustainable Business
City of Cape Town Waste Minimisation Club for the Convention Centre Construction	Cape Town	BECO – Institute for Sustainable Business
City of Cape Town Waste Minimisation Club for Blue Route Shopping Centre	Cape Town	BECO – Institute for Sustainable Business

APPENDIX 2: SUMMARY OF DANCED PROJECTS

Waste minimisation (ref. below)	Waste minimisation consists of any activity for preventing or reducing the volume and/or environmental impact of waste that is generated, treated, stored or disposed of.
Waste minimisation club	A group of companies that share information and training on waste minimisation practices. The club is usually located in a region and based on an industry sector. For example, wine-makers in a municipality. A government department that wishes to reduce pollution in an area often funds a technical and industry specialist to establish the club.

Ref: *National Waste Management Plan*, Vol. 2, Department of Environmental Affairs and Tourism, Oct. 1999.

Green chemistry (ref. below)	The design of products or processes that reduce or eliminate the use or generation of hazardous substances.
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Ref: *USEPA Green Chemistry Fact Sheet*. EPA 742-F-02-003, March 2002.

APPENDIX 4 FINANCIAL SAVINGS ACHIEVED BY THE MEMBERS OF TWO CLUBS IN DURBAN

Financial Savings achieved by members of 2 Clubs in Durban						
Company	No. of employees	Water (R/yr)	Raw mat. & consumables (R/yr)	Energy (R/yr)	Effluent & Disposal (R/yr)	Total
CLUB MFI						
A	10	7500		5060		12560
B		33000		77000		110000
C	10	5500	110000	88000		203500
D	90	12000	24750	5500		42250
E	25	11000	55000			66000
F	200		946231	78870	130790	1155891
G	400	8668	10263		29557	48488
H	30	21010	49500		11550	82060
I	9	330				330
J	50	57222	68400	33000	36520	195142
K	8	550	220			770
L	42	4769				4769
M	12		13200			13200
					TOTAL	1934960
CLUB HAMMERSDALE						
1						0
2		400000	208000			608000
3		900000	2200000			3100000
4				143000		143000
5						0
6						0
7		260000		300000		560000
8						0