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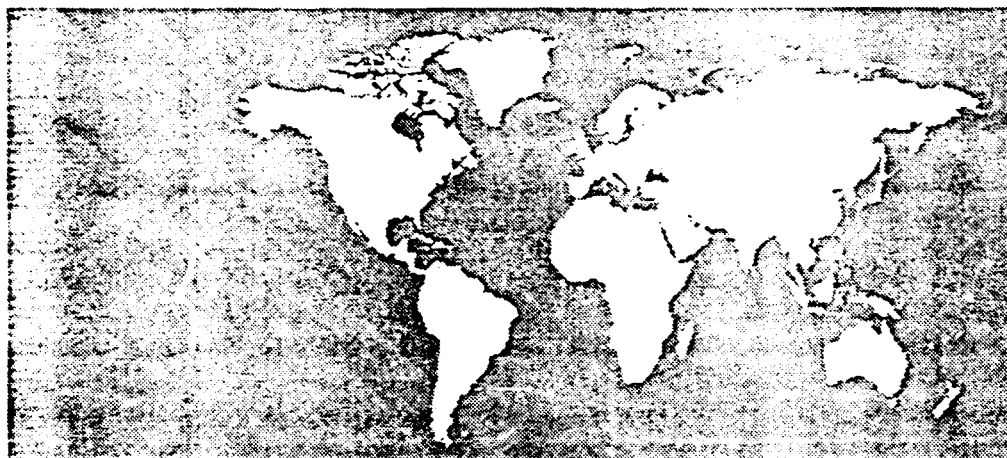
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## Panel VI Environmental policies and industrial competitiveness



**Background Paper**

## Environmental policies and industrial development: Are they compatible?

Prepared by  
the UNIDO Secretariat



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

**This study was prepared by Ritu Kumar of the UNIDO Environment and Energy Branch.**

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## I. INTRODUCTION

### The Competitiveness Issue

Concerns about the effects of environmental policies on the competitive position of industry in world markets have been expressed by industrial lobbies in developing as well as developed countries. The subject has been one of continuous debate in recent years. Firms in developing countries fear that if they are forced to meet stricter environment standards in developed countries, they will be faced with a loss in market share and export earnings due to higher compliance and production costs. Firms in developed countries have similar fears about their competitors in developing countries who are seen to derive a comparative advantage due to lower compliance costs. In addition, there is concern about the relocation of "dirty" industry from developed to developing countries to take advantage of lax environmental laws. This is of concern not only to environmental groups in the South but also to labour unions in the North. The latter see the migration of industry to the South as a potential threat in terms of job losses.

Are these fears real or perceived? What are the basis for these fears? If these fears are perceived how can they be alleviated? If they are real, how can the negative impacts on industrial competitiveness be mitigated, especially in the context of future environmental policies to be adopted by countries in the North and South. These are some issues that the present paper will examine. The paper will draw upon existing analytical work and results of case studies from developing countries and transition economies.<sup>1/</sup>

The paper examines the impact of different environmental policies on industrial competitiveness at the macro level of the nation state and at the micro/sectoral level of the firm and industry. It is shown that there may be short term adverse effects on certain sectors or firms in developing countries, but that the impacts at the macro level are insignificant. In the medium to long term, the competitive position of *efficient* firms in export markets will most likely improve due to improved quality and environmental standards.

### *Environmental Policies*

The paper discusses the impacts of different domestic and foreign environmental policies on competitiveness and trade. These include process and product standards, discharge standards, economic instruments (pollution charges user fees, tradeable permits etc.) and eco-labelling requirements in importing and exporting countries.

The General Agreement on Tariffs and Trade (GATT) rules make a clear distinction between process and product standards. Article III of GATT states that countries cannot apply process standards on their trading partners. Product standards may be defined by each country for the goods imported by them. In principle these should be applied without discrimination. In practice however the distinction between product and process standards may not be easy to maintain. Many times product standards in importing countries will inevitably dictate the processes utilised in the production of certain manufactured goods in order to ensure that the product specifications are met.

It is shown that in general international differences in **process standards** have small competitive impacts on world trade since pollution control costs are a small percent of the total value of manufacturing sales compared to other competitive factors in international trade such as differences in labour, transportation or material costs, differences in productivity, brand recognition and marketing ability. This does not necessarily mean that developing countries have not had to adjust their production processes to meet the requirements of the importing country. It only means that the impact on trade has been unclear or insignificant. As far as **product standards** are concerned, many developing countries fear that strict environmental product standards will be used as explicit protectionist barriers to trade, or as implicit marketing barriers. This makes it necessary for safeguards to be written into GATT trade agreements. The

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<sup>1/</sup> For purposes of this paper transition and developing countries are grouped under the head of developing countries.

globalisation of the world economy and concomitant increases in intra company trade and "outsourcing" can also discourage the manipulation of product standards for protectionist purposes and provides a powerful countervailing force against the protectionist use of environmental product standards.

Eco-labelling requirements in developed countries have probably been the major source of concern for developing country exporters. The multitude of schemes, lack of information, technology and institutional facilities for certification and testing could well be seen as barriers to trade and competitiveness. Since the establishment of eco-labelling criteria and procedures is in the process of being developed, measures to mitigate potential problems associated with eco-labelling requirements need to be taken at an early stage. If eco-labelling requirements are based on international labels developed with the participation of foreign countries, and on mutual recognition of labels, it would alleviate trade problems associated with eco-labelling programmes. Given the complexity of the issues involved, eco-labelling requirements and their trade implications are discussed separately in section 5 of the paper.

With respect to greater use of economic instruments for environmental protection, they may in general have fewer negative impacts on competitiveness than regulatory instruments since they internalise environmental costs of industrial activity. In general it is argued that developing countries should make greater use of economic instruments, based on the Polluter Pays Principle or the Beneficiary Pays Principle. The discussion on economic incentives (e.g. border taxes, countervailing duties) is included in the section on policy responses since they can be used to mitigate potential competitiveness impacts.

Section 2 of the paper describes the framework of analysis, definitions of competitiveness and factors affecting competitiveness that are used as reference for the remainder of the paper. Sections 3 and 4 use this conceptual framework to analyse the effects of domestic and international environmental regulations on industry at the micro and macro levels respectively. The macro analysis also includes an assessment of the implications of environmental policies on migration of dirty industries and investment location decisions. Section 5 deals specifically with the impact of eco-labelling requirements on the competitive position of firms. It discusses the implications of eco-labelling requirements in the North for developing country exporters. The compatibility of eco-labelling systems with GATT articles and the ISO 14000 standards is examined and suggestions for mitigating adverse trade effects are made. These suggestions should be regarded not as definitive ideas or proposals but rather as points of discussion for the panellists. Section 6 gives a brief analysis of the implications of the Montreal Protocol and the North American Free Trade Agreement (NAFTA) for industrial competitiveness. Section 7 of the paper presents policy responses at the sectoral, national and international levels that may be taken to mitigate and alleviate fears about the adverse consequences of stricter environmental regulations on the competitive position of industry in developing countries. The discussion is based on future perspectives and attempts to reconcile policy actions with future industrialisation and environmental scenarios. Various response options are discussed including: economic instruments and border tax adjustments, harmonisation of environmental policies, environmental/industrial policy integration, facilitation of cleaner production technologies, and, a host of measures to lessen the competitiveness impacts of eco-labelling requirements.

The concluding section of the paper attempts to identify the real issues that emerge from the debate on environment and trade. Evidence presented in the paper suggests that future concerns and areas requiring concerted efforts in the next two decades would relate not to price and competitiveness impacts per se, but rather to two sets of factors: the environmental performance of industry as measured by emissions per unit of output; and, the effectiveness of environmental expenditures by industry and government. Furthermore, commercial success may be better measured by *profitability* rather than competitiveness since it encompasses success in domestic as well as international markets and reflects costs of production along with sales volume. In this case it is better to redefine the competitiveness issue as one that looks at the trade off between environmental performance and profitability of industrial enterprises. The question that future debates should address then is: "Do establishments with superior environmental performance tend to be

more or less profitable than establishments with inferior environmental performance within the same industry?"<sup>2/</sup>

The key issues for future debates on environmental performance and profitability are presented below for consideration by the panel:

- The widespread application of cleaner production processes as opposed to end of pipe treatment only
- Greater use of economic incentives to ensure the internalization of environmental costs
- Use of environmental management systems by industry
- Special programmes to address the concerns of small scale industry
- The emergence of non tariff and market barriers such as eco-labelling requirements as perceived threats to profitability of enterprises

## II. ANALYTICAL FRAMEWORK

In order to study the real effects of environmental policies on industrial competitiveness, we need to agree on a practical and measurable indicator of competitiveness. Ideally and the most theoretically sound measure would be to study the impacts on net exports holding real wages and exchange rates constant.<sup>3/</sup> This is because we need to isolate the impact of environmental regulations on net exports from changes caused by fluctuations in exchange rates and real wages. For example a fall in the exchange rate or in real wages would lead to an increase in net exports but this cannot be considered an increase in "competitiveness". However this index of competitiveness is difficult to measure in practice because of the lack of data on isolated impacts. Thus for practical purposes it is useful to consider alternative indicators of competitiveness. The approach followed in this paper is to look at selected factors affecting competitiveness and to analyse the effects of changing environmental policies on these factors.

From this analysis it would be possible to make some deductions about the possible effects on market shares of traded goods and export earnings. A few notes of caution are however necessary. First, the indicators of competitiveness based on this approach are not entirely satisfactory since they do not take into account general equilibrium and adjustment effects on the economy as a whole, that are set in motion when regulatory measures are imposed. Moreover since data and empirical evidence on these impacts is very often lacking, the assessment of the magnitude of estimated effects is generally of a qualitative nature based on proximate indices such as the costs of compliance, productivity and investment. Second, since social benefits that result from environmental protection are difficult to measure and very little empirical evidence on these is available, the discussion in this paper focuses almost exclusively on private costs of firms and sectors. This may understate the importance of applying stricter environmental regulations especially if the costs of complying to these regulations are significant for some heavily polluting industrial sectors or firms.

### *Factors Affecting Competitiveness*

The following sets of factors may be identified as being the most important determinants<sup>4/</sup> of the degree to which environmental policies can affect the competitive position of industry at the macro and micro

<sup>2/</sup> R. Repetto (1995), *Jobs, Competitiveness, and Environmental Regulation: What are the Real Issues?*

<sup>3/</sup> See Jaffee et al (1994): *Environmental Regulation and the Competitiveness of US Manufacturing: What Does the Evidence Tell Us.*

<sup>4/</sup> See Jaffe et al (1994), *Environmental Regulation and the Competitiveness of US Manufacturing: What Does the Evidence Tell Us?*



level. Some of these are more important in determining competitive advantages at the firm level and others are more relevant to the level of the economy or nation. These sets of factors will constitute the framework for analysing competitive effects of environmental policies in later sections of the paper.

(i) Private sector compliance expenditures: these consist of operating costs and capital or fixed costs. Sound environmental policies can induce firms to use less raw material and energy inputs thereby reducing operating costs. Fixed costs may be high in the short run on account of stricter environmental regulations but are likely to decline in the longer run as they are amortised over the life of the capital stock. Moreover, if the additional compliance costs vary substantially between countries for the same industrial sector then the competitive advantage of nations that have higher compliance costs can be affected. This could also influence the location of industry and result in migration of industry from country to another.

(ii) Monitoring and enforcement costs of environmental regulations: these depend in general on the availability and efficacy of administrative infrastructure and government administration. Competitiveness effects will exist so long as there are marked differences in the stringency and enforcement of regulations between countries.

(iii) "Negative costs": these are environmental and economic benefits of environmental policies such as the impacts on productivity of better environment and resource conservation practices. A major factor here is the consequence of adopting cleaner production technologies and waste minimisation options.<sup>5/</sup> The economic and environmental benefits that flow from this are described with the help of case studies undertaken by UNIDO's cleaner production programme as well as work done by the Economic Commission for Latin America and Caribbean (ECLAC). These studies illustrate the potential benefits that firms and countries can derive by adhering to environmental regulations through the adoption of cleaner technologies and waste minimisation techniques. A study undertaken by the Institute for Applied Environmental Economics in the Netherlands has shown that production costs decrease by at least 2% per annum due to progress in environmentally friendly technologies.

(iv) Time horizon: the impact of competitiveness of firms or economies will depend on the time span under consideration. In the longer run the competitiveness effects, even at the firm level, will generally be less adverse and may even be positive on account of increased efficiency in production. Thus for long term environmental outlooks on competitiveness and compliance costs it is necessary to take technological progress into account.

(v) Firm size: smaller firms may be more vulnerable to competitiveness impacts than larger firms since they do not have the same access to information on standards especially in foreign markets, nor do they have the financial means to make initial investments in cleaner technologies to meet more stringent environmental regulations.

(vi) Factor costs: these include the costs of investment in clean technology, labour costs, and resource costs.

(vii) Structural factors: general macroeconomic factors such as the degree of openness of the economy, sectoral composition of exports, availability and prices of technology and inputs, infrastructural facilities etc., all have an impact on competitiveness of firms and the economy as a whole. In general it is difficult to isolate the impacts of environmental policy per se on competitiveness.

### III. MICRO LEVEL IMPACTS OF ENVIRONMENTAL POLICY

Many industries and individual enterprises have expressed fears about the adverse impacts of stricter domestic and international environmental regulations on their competitive position in world markets.

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<sup>5/</sup> For purposes of this paper, cleaner production processes and waste minimisation are grouped under the label "environmentally sound technologies".

Although systematic data and statistical analysis on competitiveness effects of environmental policies is lacking for most countries, whatever empirical evidence exists indicates that the impact varies between firms and sectors depending on a number of factors. The sectors most affected by stricter environmental standards are those where the compliance costs are above the average share of total production costs and investment. These are generally the more resource and pollution intensive sectors such as chemicals, mining, pulp and paper, oil refining etc. However even in these sectors empirical work done by UNIDO illustrates that in the longer run the adoption of cleaner technologies and waste reduction management practices can yield substantial economic and environmental benefits that mitigate the adverse impacts on competitiveness.

In general, the impact of environmental policies on industrial competitiveness at the level of the firm or the sector will vary between firms and sectors depending on a number of factors that include: firm size, the share of environmental compliance costs in total costs of production; competitive status of labour, capital and technology; location of the firm and its effect on resource use; scope for technological advances through environmental improvements; degree and scope for product differentiation with respect to marketing environmentally friendly products; nature and extent of international competition etc.

### *Competitiveness by Industrial Sectors*

In this section a number of case studies are examined to determine the significance of impact of domestic and international environmental policies<sup>6/</sup> (notably command and control measures) on exports and market shares of particular industrial sectors in developing countries.

The case studies have been selected from work undertaken by UNIDO, United Nations Conference on Trade and Development (UNCTAD) and ECLAC as well as other published sources. The sample of case studies reflects the experience of different export oriented industrial sectors, with varying degrees of pollution intensities and firm size, in selected developing countries. In a number of cases, experience has shown that the adoption of cleaner technologies and processes can mitigate the adverse effects on competitiveness and result in positive net rates of return.

Tables 1 to 8 summarise the findings of case studies relating to eight industrial sectors: leather, pulp and paper, textile dyeing and printing, energy, steel, iron foundries, fisheries and food processing industry. Details of these case studies may be found in Annexe 1 of the paper.

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<sup>6/</sup> Compliance to external policies may entail higher costs and therefore affect competitiveness if the external requirements are more stringent than domestic ones.

Table 1: Economic and Environmental Impact of Environmental Policies: Leather

| <i>Regulatory Action</i>  | <i>Industry Response</i>   | <i>Economic Impact (including Competitiveness)</i>   | <i>Environmental Impact</i>   | <i>Remarks</i>  |
|---|--|--|---|---|
| <b>A. Leather</b>   |  |  |   |   |
| <ul style="list-style-type: none"> <li>• European ban on use of PCP and dyes containing formaldehyde and benzidine (India)</li> <li>• Domestic regulations requiring installation of treatment plants (India)</li> <li>• Technical norm governing discharge of effluents (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Testing centres set up (in the longer run) to determine PCP content; information on PCP substitutes obtained (India)</li> <li>• Installation of clean or low waste generating technology and treatment processes e.g. chromium recovery plant, adoption of hair stripping methods for better hair recovery using less sulphide (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Compliance costs range from 1.5 % to 3.0 % of finished product prices, depending on firm size and concentration of tanning units (India)</li> <li>• Export share of small firms may decline initially, whereas modernised tanneries with labour cost advantages are least affected.(India)</li> <li>• High internal rate of return on investment in chromium recovery plant and new hair stripping methods, resulting in overall reduction in production costs (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Reduction in effluents (India, Chile)</li> <li>• Industry will be able to eliminate use of PCP by utilising substitutes (India)</li> <li>• Reduction in effluents, recovery of chromium, less sulphides (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Government reduced import duty from 150 to 50 % ad valorem to facilitate import of PCP substitutes (India)</li> <li>• Economies of scale are of particular importance---small firms scattered over a large area may suffer adverse effects.</li> </ul> |

Source: UNIDO, UNCTAD, ECLAC and other studies (1994-1995)

Table 2: Economic and Environmental Impact of Environmental Policies: Pulp and Paper

| <i>Regulatory Action</i>   | <i>Industry Response</i>  | <i>Economic Impact (including competitiveness)</i>  | <i>Environmental Impact</i>   | <i>Remarks</i>   |
|--|---|---|---|--|
| <b>B. Pulp and Paper</b>   |   |   |   |  |
| <ul style="list-style-type: none"> <li>• External requirements for increased usage of recycled materials (Argentina, India)</li> </ul> | <ul style="list-style-type: none"> <li>• Primary effluent treatment units installed by many firms, however more expensive secondary treatment plants less used (Argentina)</li> <li>• Adoption of waste minimisation options by small agro residue based mills (project DESIRE, UNIDO) (India)</li> </ul> | <ul style="list-style-type: none"> <li>• Greater efficiency in production and reduced costs due to recycling of materials in packaging (Argentina)</li> <li>• Improved efficiency in energy and water use (Argentina)</li> <li>• For 72 feasible waste minimisation options, net annual savings of Rs. 28.5 million generated for an initial investment of Rs. 9.5 million and pay back period of 6 months (India)</li> </ul> | <ul style="list-style-type: none"> <li>• Fibre recovery (Argentina)</li> <li>• Reduction in effluent volume by 32%, COD load by 31%, total solids by 40%, DESIRE project (India)</li> </ul> | <ul style="list-style-type: none"> <li>• Small sized firms using old technologies and equipment have more difficulty in improving environmental performance</li> <li>• Waste minimisation options are a feasible solution for small firms</li> </ul> |

Source: UNIDO, UNCTAD, ECLAC and other studies (1994-1995)

Table 3: Economic and Environmental Impact of Environmental Policies: Textile Dyeing and Printing

| <i>Regulatory Action</i>   | <i>Industry Response</i>  | <i>Economic Impact (including competitiveness)</i>  | <i>Environmental Impact</i>   | <i>Remarks</i>  |
|--|---|---|---|---|
| <b>C. Textile Dyeing and Printing</b>  |   |   |   |   |
| <ul style="list-style-type: none"> <li>• European ban on use of benzidine dyes (Brazil, India)</li> <li>• Stringent product standards for blue dyes (Brazil, India)</li> </ul> | <ul style="list-style-type: none"> <li>• Adoption of cost cutting scientific methods e.g. photospectrometers, process controllers, computerised colour matching, dosing apparatus etc. (Brazil)</li> <li>• Adoption of waste minimisation measures by dyeing and printing units, project DESIRE, UNIDO (India)</li> </ul> | <ul style="list-style-type: none"> <li>• Reduction in costs of domestic dyestuff by 20 to 30% (Brazil)</li> <li>• Increased costs of imported, modernised dyestuff (Brazil)</li> <li>• Savings in inputs of water, fuel, dyestuffs and auxiliary materials due to improved technologies which have a minimum payback period of 6 months (Brazil)</li> <li>• For 51 feasible waste minimisation options, net annual savings of Rs. 7.1 million achieved with an initial investment of Rs. 1.4 million (India)</li> </ul> | <ul style="list-style-type: none"> <li>• Reduced volume and toxicity of effluent as a result of increased repeatability of dyeing process, use of fixating agents and better control of temperature curves</li> <li>• Reduction in use of salt, caustic soda and acids by 40% (Brazil)</li> <li>• Volume of effluent reduced by 30%, COD load by 16%, DESIRE project (India)</li> </ul> | <p>It is feasible and cost effective for dyeing units to adhere to environmental standards without corroding competitive advantage provided appropriate technical and managerial approaches are adopted</p> |

Source: UNIDO, UNCTAD, ECLAC and other studies (1994-1995)

Table 4: Economic and Environmental Impact of Environmental Policies: Energy

| <i>Regulatory Action</i>   | <i>Industry Response</i> | <i>Economic Impact (including competitiveness)</i>   | <i>Environmental Impact</i>  | <i>Remarks</i>  |
|--|--------------------------|--|--|---|
| <b>D. Energy</b>   |                          |  |  |   |
| <ul style="list-style-type: none"> <li>• Stringent environmental (domestic and international) regulations requiring desulphurisation of flue gas; across the board market reforms manifested in increased prices of raw materials and energy (Poland)</li> <li>• Stringent standards for saline water discharges from coal mining activities (Poland)</li> </ul> |                          | <ul style="list-style-type: none"> <li>• Increase in costs of electricity generation (estimated by UNCTAD at 40%) resulting in loss of comparative advantage of electricity exports to Czech Republic and Germany (Poland)</li> <li>• Increase in price of energy intensive goods e.g. plastics, fertilisers, organic chemicals, building materials resulting in loss of export shares (Poland)</li> <li>• Production costs in coal mining may increase by 10 to 15% with consequent losses in export shares in future years (Poland)</li> </ul> | Reduction in sulphur di oxide emissions and consequent improvement in air quality (Poland) | Introduction of environmentally sound technologies would increase production efficiency in the longer run and counter the short term losses in export shares (Poland) |

Source: UNIDO, UNCTAD, ECLAC and other studies (1994-1995)

Table 5: Economic and Environmental Impact of Environmental Policies: Steel

| <i>Regulatory Action</i>   | <i>Industry Response</i>  | <i>Economic Impact (including competitiveness)</i>   | <i>Environmental Impact</i>   | <i>Remarks</i>  |
|--|---|--|---|---|
| <b>E. Steel</b>  |   |  |   |   |
| <ul style="list-style-type: none"> <li>• Environmental controls and market reforms manifested in reduced capacity of the steel industry (Poland)</li> <li>• Chilean Supreme Decree No. 4 establishing maximum permissible levels of emissions (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Application of environmentally sound industrial technologies and processes (Poland)</li> <li>• Change over from diesel oil to liquid gas in the heat treatment furnace of a medium sized laminated steel parts unit (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Capacity of steel industry reduced, however remaining plants will be more efficient with production costs lower by \$20 to \$25 per ton of steel (UNCTAD) (Poland)</li> <li>• Increase in production efficiency of steel parts unit with a positive net present value and an attractive marginal internal rate of return on investment in technological improvements (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Reduction in environmental damages from steel sector by 70 to 80% (UNCTAD figures) as a result of cleaner production processes and reduced capacity (Poland)</li> <li>• Appreciable decrease in particulate emissions from steel parts unit (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• A positive aspect of strict environmental regulations is the development of a pollution control industry as an important export sector (Poland)</li> <li>• Cleaner production processes can be economically viable for small and medium sized enterprises</li> </ul> |

Source: UNIDO, UNCTAD, ECLAC and other studies (1994-1995)

Table 6: Economic and Environmental Impact of Environmental Policies: Iron Foundries

| <i>Regulatory Action</i>  | <i>Industry Response</i>  | <i>Economic Impact (including competitiveness)</i>   | <i>Environmental Impact</i>   | <i>Remarks</i>   |
|---|---|--|---|--|
| <b>F. Iron Foundries</b>  |   |  |   |  |
| <ul style="list-style-type: none"> <li>• Chilean Supreme Decree No. 4 establishing maximum permissible levels of emissions (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• A medium sized foundry replaced a cupola furnace by an electrical induction furnace, and switched from grey to nodular iron (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Improved product quality and a positive net present value with a high internal rate of return on investment in technological improvement (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Significant reduction in emission of gaseous and particulate contaminants (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Cleaner production processes can be economically viable for small and medium sized enterprises</li> </ul> |

Source: UNIDO, UNCTAD, ECLAC and other studies (1994-1995)



Table 7: Economic and Environmental Impact of Environmental Policies: Fisheries

| <i>Regulatory Action</i>  | <i>Industry Response</i>  | <i>Economic Impact (including competitiveness)</i>   | <i>Environmental Impact</i>   | <i>Remarks</i>  |
|---|---|--|---|---|
| <b>G. Fisheries</b>   |   |  |   |   |
| <ul style="list-style-type: none"> <li>• International requirements for better quality and differentiated products (Chile)</li> <li>• Environmental pressures exerted by local communities where processing plants are located (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Development of new clean, technologies such as primary and secondary centrifugation of the pressing liquid, evaporation of liquid glue, deodorizing of drying gases, optimisation of deodorizing equipment through use of linings, application of an integrated steaming, drying and evaporation system etc.(Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Production of better quality fish meals differentiated in accordance with user needs</li> <li>• Savings of 15 to 29% in raw material usage</li> <li>• Sale of new technologies and industrial prototypes to Peru, Denmark, Norway, Japan (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• Reduction in solid content of liquid effluents by 7 to 25 %</li> <li>• Minimisation of malodorous gas emissions</li> <li>• Energy savings of 25 to 28 % (Chile)</li> </ul> | <ul style="list-style-type: none"> <li>• The technological improvements were made by the Association of Fish Meal Producers in collaboration with a Norwegian enterprise establishing a link between two countries at different development levels (Chile)</li> </ul> |

Source: UNIDO, UNCTAD, ECLAC and other studies (1994-1995)

Table 8: Economic and Environmental Impact of Environmental Policies: Food Processing

| <i>Regulatory Action</i>  | <i>Industry Response</i> | <i>Economic Impact (including competitiveness)</i>   | <i>Environmental Impact</i> | <i>Remarks</i>   |
|---|--------------------------|--|-----------------------------|--|
| <b>H. Food Processing</b>   |                          |  |                             |  |
| <ul style="list-style-type: none"> <li>International regulations for export of beef products and ostrich to European Union and Australia e.g. strict phytosanitary standards for beef exports, and quarantine regulations for ostrich (Zimbabwe)</li> </ul> |                          | <ul style="list-style-type: none"> <li>Exporters fear an increase in costs due to quarantine regulations, costly blood tests, inspection of products prior to exports. This may render the export of live ostrich birds and processed beef uncompetitive in export markets (Zimbabwe)</li> </ul> |                             | <ul style="list-style-type: none"> <li>The fear of a loss in export share is not substantiated by empirical evidence and so it is difficult to judge the extent of impact of international requirements on levels of exports (Zimbabwe)</li> </ul> |

Source: UNIDO, UNCTAD, ECLAC and other studies (1994-1995)

### Conclusion

The empirical evidence presented in tables 1 to 8 serves to illustrate the fact that competitiveness effects on individual firms of stringent environmental norms, both domestic and international, will vary depending on a number of factors, including:

- the type of industry and its share in export markets;
- firm size and location of firms;
- degree of openness of the economy and rate of economic growth;
- availability of infrastructure facilities especially for small firms;
- availability of timely information on foreign standards and environmental regulations.

Despite this diverse picture some important conclusions emerge from the evidence:

- first, negative effects on competitiveness are more likely to occur for small sized firms and natural resource intensive industries such as the food processing industry in Zimbabwe and the energy intensive industries in Poland;
- second, it is possible to mitigate the adverse effects, even in the case of smaller units, if timely and appropriate measures are taken to adopt clean technologies and waste minimisation at source. Moreover, if a quantification of the environmental benefits of these measures were possible, it would in all probability show positive net returns of adopting environmental protection measures in accordance with national priorities and concerns;
- third, timely access to foreign regulations and standards is important in lessening short term impacts on competitiveness.

#### IV. MACRO LEVEL IMPACTS OF ENVIRONMENTAL POLICIES

The analysis of the previous section has shown that micro level impacts of environmental policies, domestic and external, vary according to a host of factors, ranging from the availability of infrastructure facilities and stage of economic development to firm specific factors such as degree and scope for product differentiation with respect to marketing environmentally friendly products. What are the implications of this at the macro level? In cases where the consequences of stringent environment policies are of an adverse nature, it becomes imperative for governments as policy making bodies to examine the basis for such effects from a macro perspective. Public policy designed to mitigate environmental effects of industrial activity is formulated by national or state governments and is based on overall macro economic concerns rather than concerns of individual enterprises. Its *raison d'être* lies in social, economic and environmental improvements at the national level. This makes it important to analyse the macro economic effects of domestic and external environmental policy on competitiveness.

In the following paragraphs we examine two alternate hypothesis regarding the impacts of different environmental policies on industrial competitiveness. Two measures of country level competitiveness indicators are examined: one relates to competitiveness as measured by trade balances and trade patterns,<sup>7/</sup> and the second to foreign investments.

The first hypothesis subscribes to the view that environmental regulations and policies have a negative impact on the competitive position of developing countries. The alternate hypothesis supported by

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<sup>7/</sup> The competitiveness effects of environmental requirements, especially foreign policies, depend largely on the composition and destination of exports. The larger the share of exports of environmentally sensitive products, the more likely it is that a countries' export performance will be affected by environmental regulations.

Michael Porter argues that environmental policies can actually enhance the competitive position of a country. Is there a case for either of these two hypothesis?

### *Impact on trade balances*

Though systematic evidence in developing countries is lacking, the few studies that have so far been conducted by and large indicate that neither of the two hypotheses are empirically proven. As far as the first hypothesis is concerned (i.e. environmental regulations impact negatively on competitiveness) the only reference in the literature so far in support of the argument has been in Zimbabwe and Poland. In the case of the former it is perceived that foreign environmental regulations have made their exports uncompetitive (meat, ostrich production). In Poland on the other hand it is the domestic requirements that are perceived to impact adversely on competitiveness of industries. As mentioned in the previous section, an increase in electricity prices may adversely affect the export of certain energy intensive products. On the positive side however this is beneficial to the environment and to the growth of a pollution control industry in Poland.

Widespread evidence is also lacking in support of the alternate hypothesis that stricter regulations actually improve international competitiveness. The arguments here are that environmental legislation will spur technological changes which lead to more efficient production and improved competitive positions. Only two examples of cases can be cited where competitive positions have improved in response to stricter environmental standards. Country studies undertaken by UNCTAD have shown for example that "increased openness in China led to the adoption of environmentally sound technologies<sup>8/</sup> partly in response to foreign requirements of product quality, which have resulted in both reduced wastes and in increased profits for the enterprises operating them." In Turkey, there is a perception that stricter national standards will actually be beneficial to domestic producers. This is because existing differences in domestic and foreign standards allow producers from other developing countries to sell in the Turkish market at lower costs, depriving domestic producers of the market share.

Majority of research to date, both in developing and developed countries has shown that there is scant evidence to support either of the two hypothesis. Empirical studies have shown that the costs of pollution are a small percentage of overall production costs. On average the percentage ranges from 1.5 to 3.0 percent. Even in the most polluting sectors which spend comparatively larger amounts to comply with environmental regulations (such as pulp and paper, petroleum products, organic and inorganic chemicals, coal mining, cement, ferrous and non ferrous metals etc.), a World Bank study has found that "contrary to common perceptions higher environmental standards in developed countries have not tended to lower their international competitiveness. There has been little systematic relationship between higher environmental standards and competitiveness in environmentally sensitive goods (those that include the highest pollution abatement and control costs...)"<sup>9/</sup>

As far as developing countries are concerned, it is quite conceivable that their share in world production and trade in pollution intensive sectors has grown. However the reasons for this are not to be found in differences in environmental standards but rather in changes in demand patterns. As demand for pollution intensive products on the part of consumers and industries grows, the production pattern changes accordingly. Cost advantages in developing countries stem mainly from lower wages and material costs and not from lower environmental standards. Moreover a number of developing countries are adopting stricter environmental standards, reducing the perceived comparative advantage of lax environmental regulations.

Calculations based on average compliance costs for developing countries show that annual levels of expenditure on compliance to environmental regulations are relatively insignificant. Based on the assumption that developing countries will spend 0.25% of their GDP on industrial and environmental compliance in the

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8/ It is assumed these are changes in processes.

9/ Piritti Sorsa, Competitiveness and Environmental Standards (World Bank Policy Research Working Paper 1249 (1994)).

year 2000, UNIDO estimates<sup>10/</sup> show that annual expenditures on environmental compliance by industry will be US\$ 15 billion in 2000 A.D. An alternate estimate, based on the assumption that 1.5% of Manufacturing Value Added (MVA) will be spent on environmental compliance and that the MVA of developing countries is projected to be US \$ 1.1 trillion in 2000, shows that the annual level of expenditure on compliance to environmental norms will be US \$ 17 billion. This general conclusion for developing countries on average, is supported by evidence from country studies conducted by UNCTAD<sup>11/</sup>.

In the Philippines<sup>12/</sup> "pollution abatement costs as a percentage of total costs were less than 1 percent for majority of the sectors studied. The only sectors where these costs exceeded 2 percent were: cash crops, livestock and live stock production and electricity. Apart from these sectors, it appears that domestic environmental standards would not have a significant impact on overall industrial competitiveness."

In Colombia a survey of exporting firms showed that only 16 percent had experienced major competitiveness effects, whereas 63 percent said that the competitiveness effects were insignificant. This could of course be partly explained by the fact that Colombia's exports to countries that have recently imposed strict environmental regulations account for a small percentage of total exports.

In Argentina and Brazil, despite exports being natural resource and energy intensive with high pollution abatement costs, the competitiveness impacts have not been significant. This is due to the inherent dynamism of the industry in adapting to packaging requirements of the European Union by making timely environmental improvements.

In general, the following factors can be identified as explanations for the negligible effects on industrial competitiveness at the macro level:

- relative insignificance of compliance costs in overall costs of industrial production;
- data and methodological limitations: most macro level empirical studies are based on data from the early 1980s and would need updating to include more recent cost data as well as data on environmental benefits and costs;
- offsetting effects: the negative effects at the firm level have been offset by positive environmental benefits at the macro level. This is especially the case where cleaner technologies have been adopted resulting in greater efficiency in production, reduced input costs, reduced clean up costs and increased production of environmental goods;

#### *Impact on location of foreign investment*

Econometric investigations have also found little evidence of differences in environmental regulations resulting in industrial relocation of foreign investment to developing countries. An extensive survey by Judith Dean<sup>13/</sup> has concluded that "more stringent regulations in one country are thought to result in loss of competitiveness, and perhaps in industrial flight and the development of pollution havens. The many empirical studies that have attempted to test these hypotheses have shown no evidence to support them", the main reason for this being that environmental compliance costs are a relatively small percentage of total costs. In cases where environmental costs are a high percentage of new investment and resource costs,

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<sup>10/</sup> See UNIDO, 1994: Cleaner Industrial Production in Developing Countries: Market Opportunities for Developed Countries and Potential Cost Savings for Developing Countries by Luken et al.

<sup>11/</sup> See UNCTAD (1995).

<sup>12/</sup> See UNCTAD (1995).

<sup>13/</sup> Judith Dean, Trade and the Environment: A Survey of the Literature in Patrick Low et al (World Bank, 1992).

industrial flight or migration is more likely to occur. An example of this is the industrial relocation and migration of resource and pollution intensive industry to "maquildora zones" along the US -Mexican border.

It is true that the share of developing countries in production and trade of pollution intensive goods has increased, but this is not necessarily due to differences in environmental standards between developed and developing countries. Cost advantages of locating heavy pollution intensive industries in a particular region or country may arise due to lower wages and material costs. Environmental compliance costs are only a minor percentage of total costs. An exception to this general conclusion concerns those sectors or firms that already suffer from competitive losses due to other factors and are forced to relocate abroad in response to additional environmental regulations.

## V. ECO-LABELLING REQUIREMENTS AND THEIR TRADE IMPLICATIONS <sup>14/</sup>

As mentioned in the introductory section, ongoing efforts of industrialized countries to promote eco-labelling are probably the major concern for developing countries. There is widespread apprehension amongst developing country exporters that the multitude of schemes and lack of coordinated information on various initiatives may inadvertently reduce the export competitiveness and market access of developing countries until a greater understanding is reached.

The sheer number and diversity of various aspects of eco-labelling is overwhelming. The numerous national initiatives, primarily government sponsored, began when the German government introduced the "Blue Angel" eco-label in 1978. It now covers more than 3,500 products in almost 80 categories. Canada was the second country to initiate an eco-labelling scheme, "Environmental Choice Program", in 1988, and Japan launched its scheme, "Ecomark", in 1989. There are now approximately twenty national eco-labelling schemes worldwide including those in several developing countries, such as the Republic of Korea ("Ecomark"), India ("Ecomark"), Brazil ("Green Seal") and Singapore ("Green Label"). The European Union (EU) has developed an eco-labelling scheme that is intended to replace the national labelling programmes of member States, and it is now being implemented.

The growing diversity of activities related to environmental management in general and the need for wider government involvement, as well as the success of the ISO 9000 Series on Quality Management Systems, also encouraged the International Standards Organization (ISO) to enter the field of environmental management. In 1991, ISO and the International Electrotechnical Commission (IEC) created the Strategic Advisory Group on the Environment (SAGE), a panel of experts from member countries. SAGE considered whether international management standards would achieve the following:

- \* Promote an approach to environmental management similar to the approach for quality management.
- \* Enhance an organization's ability to improve its environmental performance and to measure the improvement.
- \* Facilitate trade and the removal of trade barriers.

The Technical Management Board of ISO followed SAGE's recommendation and created the Technical Committee 207 (TC 207) in 1993 to develop international environmental management standards (ISO 14000 series). Draft standards for eco labelling are contained in the ISO/DIS/14020 series and have been developed to lessen some of the concerns regarding the impact of eco labelling requirements.

The present section starts by describing potential trade barriers and the environmental shortcomings of unilateral eco-labelling schemes. It then summarizes the draft standard for eco-labelling (ISO/DIS/14020) and describes the extent to which the draft standard addresses those concerns.

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<sup>14/</sup> This section has been adapted from Luken et al, Environmental Management Systems and Eco Labelling: Potential Adverse Effects on the Trade of Developing Countries, (UNIDO paper, 1995).

### *Definition*

Eco-labelling means the voluntary use of labels to inform consumers that a product has been determined to be environmentally more friendly than other products of the same category. Since no absolutely ecologically sound products exist and every product has some negative impact during its lifetime, all eco-labelling systems are relative in the sense that they draw attention to products that are less harmful than similar products. Eco-labelling aims at influencing both consumer behaviour and the product's design in favour of these environment-friendly products and technologies. In markets where consumers prefer environment-friendly (green) products, eco-labels serve as a marketing tool.

Before a proper eco-labelling system can be established, a number of steps have to be taken:

- The product group to be labelled must be designated in such a way that it is clear which products belong to the group and which do not. The products should be competitive and basically fulfil the same purpose.
- A set of criteria must be chosen on the basis of which a license can be awarded to use the eco-label. These criteria must be defined so that they are measurable by standardized methods. There must also be an assessment of the ecological impact of the product during its life-cycle, including resource extraction, production, distribution, use, consumption and disposal. Such an assessment reflects an approach known as the cradle-to-grave approach.
- Reasonable limits (thresholds) for the selected criteria must be set. The setting of the limits is basically a political question. It is often handled in such a way that about 20 per cent of the products within a product group will merit the eco-label.
- It has also been proposed to establish a scoring or grading system to sum up the assessment of the product. This would entail weighing the various criteria.
- Methods of certification and verification (self-declaration or third-party declaration, for example) should be decided on.

### *Potential trade barriers associated with unilateral eco-labelling schemes*

#### a. Scarcity of information:

Because there is such a great variety of eco-labelling schemes, it may be hard to obtain information on the requirements of any given scheme. Without information on which country has developed or is going to develop such a scheme, foreign producers are unable to participate in that development or to voice their concerns. Even if the foreign producers are given the information, it is often neither timely nor accurate, and they are likely, particularly those from developing countries, to remain behind in adjusting to the new requirements. The lack of (timely) information may be aggravated by rapid changes in the requirements of overseas eco-labelling schemes. Uncertainty about the contents of the requirements and their period of validity may cause delays in investment decisions aimed at adjusting to those requirements.

The access to and demand for information depends furthermore on factors such as (a) the firm size, (b) the relationship with buyers/importers and (c) the size of the importing market.

#### b. Access to technology

The criteria, in particular process-related ones, and thresholds may be so restrictive that a specific cleaner technology or production process is called for. Manufacturers from developing countries may not yet use these cleaner technologies, and installing them may force existing facilities to be scrapped.

Cleaner technologies are not, for the most part, readily available in developing countries, and purchasing them usually involves high costs. However, as illustrated in section 2 of the paper, the potential

benefits and pay back of adopting cleaner technologies can be fairly substantial in mitigating adverse competitiveness effects. Larger firms may have the necessary funds and better access to such technology as compared to small and medium-size enterprises (SMEs).

c. Lack of infrastructure (certification/accreditation)

Measurements to assess whether the requirements of an eco-labelling scheme are being met are another concern for developing countries. Hardly any developing countries have their own capacity to assess conformity with the requirements of eco-labelling schemes in other countries. There are several reasons for this. First, most developing countries simply cannot afford to establish such a capacity. Secondly, they do not have the technical staff or the knowledge and skills to conduct such assessments. Thirdly, there are few, if any, testing laboratories. And lastly, certificates granted by domestic certification bodies may not be credible in the eyes of importers and consumers in the targeted market. The problem becomes even worse when certification bodies have to certify against the requirements of more than 20 different eco-labelling schemes.

The fact that eco-labelling schemes are more and more being based on process-related criteria makes conformity assessment even more complicated. These criteria require proof of compliance in all production phases, even those that take place outside the control of the firm that makes the final product.

Because developing countries may lack both infrastructure and credibility, most foreign eco-labelling schemes will insist on-site inspections by authorities appointed by them or on certification by an internationally recognized certification body. The French eco-labelling scheme, for example, insists that an on-site inspection should be conducted by a certified official of the standard-setting authority AFNOR. The Oeko-Tex standards for textiles<sup>15/</sup> require certification by institutes belonging to the International Association for Research and Testing in the Field of Textile Ecology. The applicant has to provide one of these institutes with samples of the product to be labelled and, furthermore, has to explain to the institute the measures taken to ensure that all the products manufactured and/or sold are of the same quality.

d. Costs of adjustment

The development, implementation and operation of an eco-labelling scheme may entail high costs for companies that do any of the following to meet the requirements of eco-labels:

- Purchase specific chemicals and other inputs: Certain criteria require specific inputs, leading to additional costs, and they may even have to be purchased abroad.<sup>16/</sup> Suppliers of input materials may use different production and process methods (PPMs) than required for the final product. The manufacturer then has the choice to change to another specialized supplier or to try to influence the PPMs of his present supplier. Either way this will cause additional costs. While large firms may be able to bear them, this will normally be very difficult for SMEs from developing countries.
- Procure new technologies: The increasing use of process-related criteria might require the use of specific technologies that are difficult to get or are expensive. In other cases, it might only require modernization of the equipment, but at a minimum that could increase costs of production.
- Conduct research studies: The use of process-related criteria calls for an extensive, and therefore costly, life cycle analysis of the products manufactured.

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<sup>15/</sup> Oeko-tex is a normative document published by the International Association for Research and Testing in the Field of Textile ecology.

<sup>16/</sup> The requirement to use specific raw materials or chemicals may in some cases be justifiable, taking into account aspects of human health and safety.



- Assess conformity: Conformity assessment becomes more complicated and expensive if all phases of the production process must be assessed, including those that take place outside the control of the company manufacturing the final product.
- Train personnel and, if necessary restructure the organization: At a minimum, the criteria would probably require additional training of the work force to meet the new product specifications. They might even require revamping the organizational structure to ensure that product specifications are met. In addition, if there are PPM-related criteria, many additional personnel would need training.

The costs of compliance measurements become even more onerous if an applicant has to comply with the requirements of many different eco-labelling schemes.

Developing countries often find it difficult to bear the costs of compliance not only because they lack the necessary funds but also because existing funds compete for other, more urgent environmental and social problems. If, for instance, a company in a developing country facing water pollution problems is required by an importer to take measures protecting air quality in order to obtain the label, it may not be able to meet this requirement because domestic environmental regulations mandate water protection, which absorbs all the company's financial resources.

#### e. Selection of product categories and criteria

Domestic producers can more easily influence the selection of new product categories to be granted a label than can foreign producers, thus excluding products that are of export interest to foreign producers. In Germany and Canada, for example, more than 70 per cent of the proposals for new product categories are made by domestic industry. Foreign producers are concerned about losing market access because their formerly competitive products would not be able to obtain an eco-label. This situation arises mainly because developing countries' producers do not participate in the selection of product categories or because they have no funds for research on product categories suitable for labelling.

The same problem occurs in determining the criteria for awarding an eco-label. Because domestic producers have a greater input, the criteria may be particularly problematic for foreign exporters. They may focus on environmental attributes that can be met more easily by domestic firms because they are already part of the domestic regulatory scheme. Certain criteria may require the use of an input (for example, a dyestuff) that is not available in the developing country. Alternatively, more emphasis on recycling might force developing country producers to use materials that can be recycled in the importing country even though these materials are less environment-friendly than the materials traditionally used in the producing country. In the end, the determination of criteria and thresholds may be so narrow as to focus mainly on the economic and environmental concerns of the importing country, not taking into account the environment-friendly inputs and/or PPMs available in developing countries. Any environmental achievements by manufacturers in developing countries that are not addressed by the criteria of a particular eco-labelling scheme will be overlooked.

These concerns become even more serious when it is considered that many criteria and their thresholds are not objective or have no scientific basis.<sup>17/</sup> It is difficult to compare the different environmental impacts addressed in the eco-criteria. For example, on which basis should one decide which of two products is more environment-friendly. One product is produced by an energy-intensive process but causes low emissions. The other is produced with little input of energy but causes high emissions. Since there is no agreement on how to weigh different environmental impacts nor is there a procedure for evaluating the net or total environmental impact of a product, the determination of eco-criteria and their levels inevitably involves value judgements.

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<sup>17/</sup> The inadequacy of scientific data makes it difficult for the institutions to select appropriate criteria for granting the eco-label or to set thresholds for those criteria. It will lead to poor decisions based on judgements that lack objectivity and may severely affect international trade.

### *Environmental shortcomings*

Although eco-labelling schemes aim at protecting the environment and thus contributing to an increase in welfare, several aspects of them may be inefficient from the environmental point of view:

- To assess the social costs of environmental protection and resource depletion associated with the production and consumption of a product, it is necessary to first assess the total environmental impact. There is still no scientific basis for weighing different environmental impacts or for evaluating the overall environmental impact of a product. Therefore, any measures undertaken on the basis of uncertain scientific data may lead to even greater environmental damage. This does not mean eco-labelling schemes should be abolished but rather that research efforts should be greater.
- The difficulties of developing a comprehensive set of criteria often cause all but the most important environmental impacts in a product's life cycle to be ignored. Criteria are then derived addressing the most important aspects. This will of course involve a large number of value judgements, which are not very objective from the environmental point of view. Environmental efforts in areas not covered by these criteria will simply be disregarded.
- The criteria and thresholds are likely to be based on domestic production patterns and to focus on local economic and environmental conditions and priorities. Environmental conditions, especially assimilative capacities, vary among countries. As a result, process-related criteria set up by the developed country may not reflect the developing country's environmental realities and goals and may therefore be inefficient from the environmental point of view. Foreign producers will have to divert scarce capital resources from projects of greater environmental importance to those of lesser importance, thus leading to a suboptimal allocation of resources.

### *Impacts of ISO/DIS 14000 Standard Series<sup>18/</sup>*

ISO has defined three types of labelling systems that promote the environmental virtues of a product:

- EL-type I: Third-party certified eco-labelling programme based on several criteria.
- EL-type II: Environmental claims by the manufacturer.
- EL-type III: Quantitative information that has been independently verified using preset indices.

The main objectives of the draft standards for EL-type I (ISO/DIS 14020) are to promote market driven demand for and supply of products that reduce stress on the environment, to avoid compromising product safety or significantly affecting product function and to provide accurate, verifiable and relevant information to the consumer.

The standards require adherence to the following principles. First, eco-labelling schemes must be voluntary. Secondly, to make them credible, two conditions must be met: (a) Transparency (sound scientific methods, repeatable and reproducible, for developing the criteria; consultation with interested groups); (b) Third-party certification. Thirdly, the products have to comply with the environmental regulations of the country where they are manufactured and the country where they are being marketed. Fourthly, eco-labelling schemes should take a cradle-to-grave approach to avoid the transfer of environmental stress across media. Lastly, they should not discriminate in their treatment of domestic and foreign goods.

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<sup>18/</sup> This paper was written prior to release of the ISO/DIS/14000 series. The analysis presented in this section is based on the recommendations of the Technical Committee 207 and the TC 207/CD 14020 standards. The latter were the basis for formulating the ISO/DIS/14020 standards and the two are almost the same. Currently UNIDO is in the process of analysing the ISO/DIS/14000 series for further consequences.

The ISO 14020 standards lessen or even eliminate some of the concerns mentioned above:

- The lack of information can be remedied by providing more transparency and communicating information on criteria, certification and award procedures to interested parties. Transparency involves allowing the interested parties to participate in developing criteria and certification procedures as well as notifying both domestic and foreign producers at an early stage about the product categories and criteria.
- Problems related to certification/accreditation and credibility can be largely solved by the provisions of the draft standard. The draft standard provides guidance on certification procedures. It contains the various procedures for assessing conformity that prevail in different countries as a result of different circumstances, e.g. legal frameworks. To make an eco-label more credible, the standard calls for third-party certification.
- To mitigate some of the problems arising from the selection of eco-criteria, the standard suggests that the criteria should be objective, comprehensive, transparent and relevant, taking into account the use of natural resources as well as environmental burdens across all media. They should be periodically reviewed in the light of new technologies, new products on the market etc. and should be based on proven technical and scientific assessment.
- Addressing the potential environmental shortcomings of eco-labelling schemes the draft standard calls for the following: First, in order to achieve a real reduction of stresses on the environment and not to merely transfer stress across media or the life cycle stages of a product, eco-labelling schemes should be based on a comprehensive, cradle-to-grave approach to setting criteria. Secondly, the requirements for compliance with environmental process-related regulations at the producing site must be flexible and take into account, where possible, the producing country's own environmental requirements.

Although this general guideline will help to harmonize the various unilateral eco-labelling schemes and will therefore make compliance with the requirements for obtaining the eco-label easier, it will not abolish all problems and concerns. *The problem of inadequate or non-existent infrastructure and technical capabilities for certification will remain.* Nor can the standards solve the problem of appropriate technology. The costs of adjustment will probably be somewhat lessened by harmonization but will remain a considerable obstacle for most producers in developing countries. In setting up eco-criteria, scientific evidence will often be lacking because of the dearth of research institutes or knowledge and skills.

#### *Suggested actions to address developing country concerns*

In order to alleviate fears and concerns of developing country exporters, a joint effort involving developing countries, developed countries and the international community is required. The actions suggested below would need considerable inputs from international and multilateral aid agencies.

##### a. Internationally agreed-upon labels

Consumer preferences for environment-friendly products may create trading opportunities for developing countries. The problem faced by most consumers and producers is the difficulty of defining environment-friendly products. Even though in theory eco-labels should help the consumer decide on purchases, the great number of labels often adds to the confusion instead of reducing it. The creation of a single, internationally agreed on eco-label might help to counter the proliferation of national labels, many of which are misleading. It might also alleviate the trade problems associated with eco-label programmes. To formulate an international label based on uniform criteria, differences in environmental, social and economic conditions have to be considered and the countries that will be most affected by the label need to be consulted. Any deviations from the internationally agreed-on criteria or the use of a separate eco-labelling scheme should be justified.

b. Mutual recognition

A developing country's use of its own eco-label on export goods may have only limited success, mainly because consumers in developed countries have reservations about the quality promised by such a label and will continue to prefer products with a better-known label. The use of an international label might therefore be more successful. However, if neither an international guideline nor an eco-label is established, an alternative might be the mutual recognition of national eco-labelling schemes. The idea here is to recognize the validity of divergent environmental criteria and to ensure that trade interests are not unduly affected by that diversity. Under mutual recognition, if certain requirements are met, the fact that a product qualifies for an eco-label in the exporting country would be the basis for awarding it an eco-label in the importing country.

There are three different types of mutual recognition. An exporter may obtain a label in the importing country, if it complies with one of the following:

- The criteria of the exporting country.
- The PPM-related criteria of the exporting country and the product related criteria of the importing country ("cradle-to-export-border and import-border-to-grave" approach).
- The criteria of the importing country, with certification being undertaken, however, by the exporting country's eco-labelling programme.

The first form of mutual recognition implies that the eco-criteria set up in the exporting country are equivalent to those set up in the importing country. The second form takes into account environmental conditions in both the producing and importing countries. The third merely entails recognition of the testing and verification bodies of the exporting country by the importing country. One basic requirement of the mutual recognition concept is mutual confidence among eco-labelling scheme authorities.

c. Equivalency

Another approach that would avoid trade discrimination and take into account environmental conditions and priorities in the producing country, in particular a developing country, is the concept of equivalency. When compatible environmental goals can be achieved in different ways, different criteria can be accepted as a basis for awarding eco-labels. Besides being a basic requirement for mutual recognition of eco-labelling schemes, the concept of equivalency can be used even if the exporting country does not have its own eco-labelling scheme. Environmental regulations in an exporting country may in some cases be accepted as equivalent to meeting eco-criteria/thresholds in the importing country. The concept of equivalency may also be applied to different eco-labelling schemes in the importing and exporting countries. Since the main idea of equivalency is to take into account environmental conditions in each country, it is more easily applied with process-related criteria than with product-related criteria.

d. Transparency/participation

Improving the transparency of eco-labelling schemes may also mitigate any potential adverse trade effects. There are a number of ways to do this:

- Spell out environmental objectives and scientific principles.
- Provide early notification of new schemes, product groups and criteria.
- Solicit comments on draft criteria.
- Publish draft criteria.
- Arrange the participation of all interested parties in determining criteria and thresholds.
- Clarify the labelling process and methodology.
- Set up information centres.
- Carry out information campaigns.
- Use sound, repeatable and reproducible scientific methods when developing criteria.
- Make the rationale and details on which the eco-labelling scheme is based clear and open for examination.

e. Technical assistance

Many developing countries lack the technical know-how to establish their own eco-labelling schemes. Technical assistance in testing and verifying products and plants by developed countries or international organizations could overcome this problem. The fact that such assistance has been rendered may lend credibility to the eco-labels of a developing country. Testing, certification and verification can also be undertaken by international certification firms. However, if rights are awarded to only a few international certification firms, they may set excessively high prices. Therefore efforts must be made to encourage competition.

f. The provisions of the agreement on Technical Barriers to Trade

The agreement on Technical Barriers to Trade (TBT), a subsidiary agreement to GATT, has been established to provide transparency and notification disciplines on technical regulations, standards and conformity assessment procedures. Following significant revision of the TBT, the definitions for technical regulations and standards now include process and production methods relating to the final characteristics of the product (previously they had included only the final characteristics of the products).

It seems that to the extent that eco-labelling schemes create standards or technical regulations stipulating product characteristics or PPMs related to those product characteristics, they are subject to the disciplines of TBT. In particular, mandatory eco-labelling schemes follow under articles 2 and 3 of the TBT, while voluntary eco-labelling schemes are covered by article 4 of the TBT and by the Codes of Good Practice for the Preparation, Adoption and Application of Standards.

TBT requires adherence to five principles:

- Non-discrimination against imported products.
- Transparency in the development and implementation of standards.
- Acceptance of equivalent technical standards of other countries.
- Special and differential treatment for developing countries.
- Scientific basis for a standard.

Under TBT, technical standards that have an impact on trade are permitted only to the extent that they are the least trade-restrictive measure necessary to fulfil a legitimate objective. A legitimate objective is defined to include the prevention of deceptive practices and the protection of human health or safety, animal or plant life or health, or the environment. If a technical standard is created to fulfil one of these legitimate objectives and is based on an international standard, it is presumed not to be an unnecessary obstacle to international trade and, therefore, consistent with GATT.

An eco-labelling system, even though voluntary, might be considered as causing unnecessary barriers to trade under the provisions of TBT if:

- The criteria that the product must conform to in order to qualify for the label, in particular with regard to the use of raw materials and production and processing methods, are not based on objective or scientific consideration or fail to take adequately into account the production processes prevailing in other countries.
- Procedures for verification in granting the label are unnecessarily strict or rigorous, making it almost impossible for a foreign producer to obtain the label.
- The eco-label is adopted for a product that is almost entirely imported and the right to grant an eco-label rests entirely with the authorities of the importing countries.

g. Others

A number of other measures might lessen the potential adverse effects of eco-labelling schemes:

- Promote the credibility of eco-labels, especially those from developing countries, and their acceptance by consumers.
- Facilitate the transfer of cleaner technology to developing countries.
- Provide financial support (by developed countries) to help developing countries improve their environmental performance.
- Increase the awareness of consumers and industry about environment friendly products.
- Implement environmental management systems to assess the costs and benefits of applying for an eco-label.
- Improve dialogue and cooperation between manufacturers and suppliers.
- Seek greater integration of trade and environmental policies.

### ***Conclusion***

Eco-labelling has the potential in the short run to reduce export opportunities of developing countries, assuming that it becomes a significant marketing tool in developed countries. Developing countries lack the pertinent information and infrastructure (certification and accreditation bodies) needed to qualify for many eco-labelling schemes. Their firms have limited access to cleaner technologies and may incur relatively high compliance costs in meeting the requirements for eco-labelling schemes, which are becoming even greater with the growing use of process-related criteria for awarding eco-labels. In addition to having potential economic impacts, eco-labelling schemes could also distort the environmental priorities of developing countries by diverting pollution reduction expenditures to address the concerns of developed countries.

The ISO/DIS/14000 documents have the potential to overcome some of these negative impacts. However, more efforts in the areas of international labels, mutual recognition, certification, equivalency, transparency, participation and technical assistance are needed to ensure that eco-labelling are not perceived to be or do not even become barriers to trade.

## **VI. INTERNATIONAL AGREEMENTS, ENVIRONMENT AND COMPETITIVENESS**

Multilateral environmental agreements (MEAs) are essential for tackling global environmental problems such as greenhouse gases, ozone depleting substances, and transboundary movements of hazardous wastes. Available, albeit scant evidence on the trade and competitiveness effects of MEAs is limited to a few agreements such as the Montreal Protocol. In addition to specific MEAs, environmental consequences of general trade agreements such as the North American Free Trade Agreement (NAFTA) and the Uruguay Round may also have an impact on industrial competitiveness. Once again it is difficult to quantify these impacts, although attempts have been made by various authors to analyse some of these consequences. Discussion in the present section is limited to impacts of one MEA i.e. the Montreal Protocol and one trade agreement i.e. NAFTA.

### ***The Montreal Protocol and Industrial Competitiveness***

The Montreal Protocol sets schedules for the gradual reduction in consumption and production of ozone depleting chemicals. The original agreement which came into effect in 1989 placed controls on the manufacturing, export and import of two groups of ODSs i.e. chlorofluorocarbons (CFCs) and halons, with the goal of a 50 percent phase out by the end of the century. Each group of countries has its own phase out schedule. Developing countries (Article 5) as a group are required to achieve 50 percent phase out by year 2010. Since the signing of the original agreement, the phase out requirements have been tightened by the London and Copenhagen Amendments (1990 and 1992 respectively) and new substances were added. Accordingly, a complete phase out of the major ODSs must be achieved by 2006 by Article 5 countries. The major ODSs are CFC (used as refrigerants, foam blowing agents, aerosol propellants, and solvents), halon (used in fire fighting equipment), carbon tetrachloride and methyl chloroform (both used as solvents).

In order to assist developing countries to do this, the Multilateral Fund was set up in 1990 to provide concessional finance and grants to developing countries. The Montreal Protocol incorporates financial and

technical assistance as well as a few trade measures. The latter are to be used only as a last resort in the event of non compliance.

The impact of the Protocol on competitiveness of industries that produce or use ODSs depends on two identifiable sets of factors: the level of incremental costs of converting to non ODS methods of production, and, trade restrictions that may affect the export of ODS using substances e.g. refrigerants.

a. Incremental Costs

Incremental costs of phase out include the costs of reconfiguring CFC plants to produce substitutes; retooling refrigerator factories; recovery, reclaim and recycling of CFCs, technical assistance, training and operating costs etc. Grant financing is available to countries that use less than 0.3 kgs of ODS per head per year to cover their incremental costs<sup>19/</sup>. The impact of these incremental costs on industrial competitiveness, given the availability of grant financing, may be lower than expected. Even so, the political compromises that accompanied the establishment of the Montreal Protocol have hampered the full realisation of economic benefits from the Protocol. This is because there is no provision of additional financial incentives that would encourage the accelerated phase out beyond the targets set. By reimbursing only the incremental costs of developing countries, there is no financial incentive for accelerated depletion, the benefits of which would far outweigh the extra costs. This is especially true for transition economies. According to a report by UNIDO<sup>20/</sup>, a significant barrier to the rapid conversion of the ODS producing and consuming enterprise in Rumania is the lack of domestic funding and inaccessibility to international capital markets. For the ODS phase out to be economically feasible in Rumania it is may be more conducive to provide additional financial incentives to accelerate the phase out.

One way to speed up implementation and reduce costs would be to supplement the present approach by appropriate technological assistance and facilitate the transfer of technology through the aegis of international agencies such as UNIDO, UNEP, the World Bank and UNDP that are currently assisting developing countries in implementing the Montreal Protocol.

b. Trade restrictions

In addition to the issue of incremental costs, there are concerns among developing countries with respect to trade restrictions inherent in the Protocol. The original agreement in 1985 included restrictions on trade with non signatories, in ODSs and in products containing ODSs. Amendments to the Protocol extend the restriction to a list of products produced with but not containing ODSs. The latter has yet to come into force. Trade restrictions already in effect include:

- ban on import of ODSs from non signatories (1990)
- ban on export of ODSs to non signatories (1993)
- ban on import of products containing controlled substances from non signatories (1993)

Whereas the imposition of trade restrictions has proved to be an important factor in inducing some countries to join the agreement, it has also led to a decline in exports for some countries. For example in China, according to some estimates, the exports of refrigerators using ODSs has declined by 58 percent between 1988 and 1991. The positive side to this however is that China has stepped up its phase out programme and aims to achieve its targets faster than stipulated in the Montreal Protocol. In Thailand on the other hand, the feeling is that industry will be able to transfer to ODS free production without major

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<sup>19/</sup> According to the London amendment, the consumption of the additional ODSs should not exceed 0.2 kgs per capita per year.

<sup>20/</sup> Country Programme for the Phase Out of Ozone Depleting Substances in Rumania, 1995 by UNIDO, Ministry of Waters, Forests and Environmental Protection, Danish Environmental Protection Agency.

impacts on trade. The impact may however be more severe if trade restrictions are extended to substances made with but not containing ODSs.

In conclusion, by its very nature, the Montreal Protocol involves trade restrictions and incremental costs. In most cases however these costs can at least be reimbursed through financial assistance from the Fund. It would be more cost effective if additional financial incentives and technical assistance is provided to developing countries to accelerate the phasing out of ODSs. Also, the negative effects of trade restrictions on export earnings, wherever they may arise can be offset by suitable compensation through negotiations with the Protocol.

### ***NAFTA, Environment and Industry***

The North American Free Trade Agreement (NAFTA) has created the world's largest market and opened the Mexican economy to US and Canadian exporters, investors and service agents. Clearly the promotion of trade and investment in the region will have effects on the physical environment and on environmental policies and programmes. These effects will not be limited to the three signatory countries, but would permeate the Central and South American region as a whole. The following discussion, while concentrating on NAFTA is relevant to other regional agreements (such as the Southern Common Market, MERCOSUR) as well.

The competitiveness impacts arising from the environmental implications of NAFTA are still to be seen. There are several issues, both positive and negative, that could arise. These are discussed briefly in the following paragraphs.

#### **a. Potential negative impact**

(i) The increased inflow of foreign capital into the region may accelerate investment in natural resource based industries in which the region has a comparative advantage. This could place the region's environment at greater risk. Higher investment in mining, fishing, agrofruit production, forestry and the tourism industry will put additional pressures on the region's environmental resources.

A related concern stems from the fact that the pressure on natural resources would require countries in the region to focus more on the environmental agenda, and could therefore legitimise the use of international trade barriers for environment protection. This in turn could affect the competitive advantage of industries.

(ii) Free trade agreements normally entail a greater specialization of industry which will weaken the position of non competitive sectors, and require structural changes (for example in the scale of production) in others. The extent of environmental impact from pollution will depend on the country's industrial structure. Structural changes in the region's industry resulting from greater trade liberalization and, specifically, agreements such as NAFTA, have yet to be specified in detail. However it is likely that a greater development of commodities industries linked to natural resources will take place. Such industries are not only resource intensive but also pollution intensive.

(iii) Due to the need for greater specialisation and adherence to more stringent environmental regulations inherent in free trade agreements such as NAFTA, it may be that small and medium scale enterprises in the less developed parts of the region (e.g. Mexico) are unable to comply with the regulations without substantially increased costs. The increased environmental requirements may place small- and medium-scale enterprises, and those industrial sectors that are teetering on the verge of competitive efficiency, in a more critical situation.

(iv) The economic changes that will accompany the implementation of NAFTA can place additional stress on the environment, especially for the transport and trade related activities at border crossings.

In anticipation of some of these effects, a parallel agreement on Environmental Cooperation was also signed. This does not impose new environmental regulations on its signatories (more stringent laws,



stricter standards, etc.). Rather, it recognizes "the right of each Party to establish its own levels of domestic environmental protection and environmental development policies and priorities, and to adopt or modify accordingly its environmental laws and regulations". However, there is an understanding that "each Party shall ensure that its laws and regulations provide for high levels of environmental protection and shall strive to improve those laws and regulations".

The NAFTA signatories have agreed on the establishment of an independent organization, the Environmental Cooperation Commission, whose tasks include the following: (a) strengthening international cooperation in respect of developing and improving national environmental laws and regulations; (b) cooperating with the Free Trade Commission established in the main body of NAFTA in order to prevent or resolve disputes connected with the environment and free trade; (c) developing recommendations on measuring the environmental impact of projects that may have adverse transboundary effects on the environment; (d) Promoting public information on hazardous substances and activities; and (e) developing recommendations on a broad range of environmental matters, including technologies and strategies for preventing pollution, the environmental ramifications of production methods, transboundary environmental matters, and so on. One important function of the Commission is to intervene in conflicts arising from inadequate supervision of national environmental laws. Arbitration mechanisms (panel of arbitrators) and fines and other economic penalties have been established to compel enforcement.

An agreement has also been adopted within the framework of NAFTA that tends to improve periodic reporting on the environment in the member States. It proposes a commitment to take steps periodically to combat environmental hazards, promote environmental education, including legislation on the environment, encourage scientific research and the development of environmental technology, assess environmental impact as and when needed and promote economic instruments for the efficient fulfilment of environmental goals.

#### b. Positive impact

(i) Owing to the increased external exposure caused by the free trade agreements and the more stringent environmental requirements of the developed economies, it is believed that countries which sign agreements such as NAFTA tend indirectly to establish more stringent and better supervised regulatory frameworks with streamlined, equitable and transparent access mechanisms and higher levels of participation by society.

(ii) The more rapid development of new and dynamic export sectors, especially the natural resources sectors, as well as the greater flow of financial capital, may cause the exchange rate to fall. This will eventually force Mexican industry to accelerate its process of changing production patterns, including the adoption of clean technologies, in order to seek higher levels of profitability and competitiveness. The higher productivity requirements placed on factors of production (labour and technology), the saving of energy and materials and the improvement of enterprise management are competitiveness factors that industry will have to develop and emphasize in order to maintain or improve its competitiveness. This will also have a positive impact on the environment.

In conclusion, the competitiveness impacts of environment related NAFTA clauses are still unclear. However the existence of parallel provisions for technical and financial assistance provide a reasonable cushion for lessening adverse impacts.

## VII. DESIRED RESPONSE OPTIONS

The foregoing analysis indicates that the link between environmental policies and competitiveness is complex and it is difficult to isolate the impacts of environmental policies per se on trade and competitiveness. At the firm level the impact may be negative for some sectors, especially in the short run. In the longer run and at the macro level, impacts on competitive positions of firms and countries are insignificant.

Analysis of the links between environment policies and industrial competitiveness suggests a number of response measures that may be adopted at the sectoral, national and international levels to mitigate adverse impacts if any and alleviate fears about stricter environment protection actions that are likely to be taken in the future. In the following paragraphs, these measures are grouped under six heads: economic incentives and border tax adjustments; harmonisation of environmental policies for global problems; environmental and industrial policy integration; maximising trade and income gains from environmentally sound resource management; technical assistance for adopting of cleaner production processes and technologies; specific measures for counteracting adverse impacts of eco-labelling requirements.

### *Economic instruments and border tax adjustments*

Economic instruments such as pollution charges, user charges, tradeable permits, and realistic cost pricing of natural resources are increasingly being advocated as measures for addressing environmental problems. They are often preferred to command and control measures because:

- they are more efficient,
- more cost effective,
- and provide incentives for pollution control.

This is a consequence of the fact that economic instruments serve to internalise environmental costs. The objective of internalisation is to include external costs and benefits (associated with pollution for example) into the decision making process of producers and consumers. There can be negative effects of internalisation policies but these would dominate only when the environmental costs associated with production are so high that:

- internalisation requires a very large tax;
- the country internalises the full external cost instantaneously and unilaterally;
- the world demand and competing supply are very elastic;
- the country retains a small part of the market.

In cases where negative effects dominate on account of application of eco taxes, they can be offset by differential taxes, sector exemptions or rebates, and border tax adjustments. A border tax adjustment is the imposition of a charge on imports corresponding to the domestic environmental tax or charge borne by a substitute domestic product. Likewise it could be an exemption or rebate on exported products. World Trade Organisation (WTO) rules allow border tax adjustments on final products and intermediate inputs (provided transparency, most favoured nation treatment and national treatment obligations are met) but not on primary inputs and processes. For these reasons product taxes may be preferred to process taxes since they can be adjusted at the border.

A few words of caution need to be noted in advocating border tax adjustments for mitigating adverse competitiveness effects:

- If eco taxes are imposed to dissuade the use of a particular production process or input in the domestic economy, then rebate of export tax to lessen competitive effects could defeat the purpose of the tax.
- Since the significance of higher compliance costs on differences in competitiveness positions of countries is not clear, compensation by border tax adjustments can be questionable;
- In case border tax adjustments are made in response to product or process regulation rather than to eco taxes, the product may be "overtaxed" since it already bears additional costs of complying with the standards which cannot be adjusted at the export point.
- The use of eco taxes and border tax adjustments has inherent advantages from an economic and environmental point of view, however further work needs to be undertaken on the formulation and

application of economic instruments for pollution prevention in developing countries to enable them to exploit the advantages of using these instruments.

### *Harmonisation of environmental policies*

The harmonisation of environmental policies is advisable only in the case of global or transboundary environmental problems. The claim that differences in environmental standards result in competitive disadvantages for some countries has not been adequately proven by empirical evidence. Moreover demands by certain environmental lobbies to "level the playing field" are not legitimate since identical process standards (for example) in two different contexts will not necessarily result in the same level of environmental quality. Other factors such as assimilative and carrying capacity of the environment and concentration of emissions are equally important. The effectiveness of environmental measures also varies between countries at different stages of economic development. It would be unrealistic to expect that the goal of very low levels of discharge from industry embodied in the US Clean Water Act be applied in India where surface waters are contaminated with domestic waste rather than industrial waste. In case of domestic environmental concerns therefore the principle of national sovereignty must be respected and uniformity of standards is not advisable.

For global problems however, a case can be made for harmonisation of process and ambient standards, particularly when actions by individual countries can have negative competitive effects on domestic industries.

### *Environmental and industrial policy integration*

Closer integration of industrial and environmental policies and the adoption of ecologically sustainable industrial development (ESID) strategies could go a long way in easing competitiveness effects and facilitating environment related structural adjustment of the economy. This is particularly true of strategies and measures to promote cleaner production technologies and waste reduction at source.

Governments in developing countries need to take more initiatives to involve industry in the decision making process and to provide the enabling policy framework by giving incentives for research and development of cleaner production methods, investment incentives and infrastructure support. So far, the approach to reducing environmental damage has been one in which "end of pipe" technologies dominate. The new approach that is emerging as a result of more stringent environmental regulations and the need to maintain comparative advantages must be based on pollution prevention. The approach encompasses both policy and micro aspects. At the policy level it includes influences on supply side factors (i.e. technological choice etc.) and on the level and structure of demand. For example, a price (or regulatory) policy that limits the use of synthetic fertilisers could be as effective in improving the environment as technical measures to make the production of fertilisers less damaging to the environment. At the micro level the approach emphasises the prevention of damages i.e. applying production processes that are cleaner, using less energy and creating cleaner products. This cradle to grave approach should also include a reduction of raw material requirements through recycling thereby reducing the raw material content of products.

In considering the choice of policy instruments that would give the right signals to private agents, it is important to arrive at the right mix of policy instruments. The elements of such a mix would vary depending on "specific considerations such as the regional extent of the problem, the number of pollution sources, the ease of monitoring, the importance of transaction costs and the pervasiveness of other market distortions. Policy options should be as possible informed by cost benefit analysis"<sup>21/</sup>. Three broad categories of policy measures for the formulation of ESID strategies can be identified. These are:

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<sup>21/</sup> OECD Economic Studies no.16

a. Economic incentives and disincentives

These are necessary for government policy to establish the link between resource scarcity and prices so as to improve resource management and promote sustainable development. The following aspects of policy reform should be addressed:

- internalisation of environmental and social effects of industrial policy;
- correction of market failures;
- elimination of market distorting policies.

Economic mechanisms suitable for inclusion in environmental management systems include:

- fiscal measures (taxation, accelerated depreciation, elimination of subsidies, tax rebates, government procurement, effluent charges, product charges and administrative charges)
- direct financial support
- tradeable permits
- liability insurance legislation.

It is important that these measures be formulated in a manner that does not conflict with industrial development objectives.

b. Regulatory policies

Discharge standards, technology based standards, benefits based standards and ambient quality standards, have been the traditional instruments of command and control used by governments to control pollution emissions. Effective implementation of these norms would require an efficient system of monitoring and enforcement, very often lacking in developing countries and transition economies. The setting of standards would also require the following institutional and technological facilities:

- compliance monitoring systems;
- analytical laboratories;
- legal instruments (laws and decrees);
- information on technology for waste minimisation and waste treatment.

c. Locational policies

Locational policies are needed for the siting of industry, which optimise environmental aspects with imperatives for regional balance, availability of energy and raw materials, and local and regional aspirations. Of special interest are policies relating to Industrial Free Zones and Export Processing Zones. Developing countries have a tremendous pressure to set up export oriented industries. It is important to ensure that these industries abide by environmental regulations while maintaining their competitive position in world markets.

*Maximising trade and income gains from environmentally sound resource management*

Policy initiatives at the local, national and international levels should seek to give institutional support for finding solutions to maximise the value added of internationally traded resources. The following are some examples of such initiatives:

- Maximising value added from forestry and fisheries resources as well as biodiversity
- Improving access to international markets and diversifying into more environmentally friendly products having a higher value added.
- Supporting research in areas and conditions where "green premiums" i.e. premiums from investments in environmentally friendly products and processes are likely to accrue

- Reducing uncertainty regarding requirements of ecopackaging by providing information as well as technical assistance in setting up such schemes based on the availability of natural and local resources. Assistance may also be given to entrepreneurs in the creation of regional markets for environmentally preferable packaging materials.

*Technical assistance for adopting of cleaner production processes and technologies*

Irrespective of whether green premiums accrue, investments in pollution prevention and abatement may be costly for the small and medium scale enterprises. It is therefore imperative that future assistance should aim at facilitating the transition of small and medium scale enterprises to cleaner production processes. This may be done by the provision of technical assistance and transfer of cleaner and appropriate technologies through multilateral and bilateral assistance programmes. Such assistance could take various forms such as demonstration of the economic and environmental benefits of cleaner production processes, waste minimisation techniques, better information dissemination, training programmes, and research into cost effective solutions.

Several examples of the economic and environmental benefits of utilising cleaner production processes with assistance from multilateral agencies such as UNIDO have been cited in section 3 and in Annex 1. Additional examples of the benefits of cleaner production programmes implemented with bilateral or multilateral assistance are to be found in India, Tunisia, and the Czech Republic<sup>22/</sup>.

In India, UNIDO in collaboration with the National Productivity Council conducted the DESIRE project (DEmonstration in Small Industries for Reducing wastE) to demonstrate the financial and environmental benefits of cleaner production to SMEs in agro based pulp and paper mills, textile dyeing and printing, and pesticides formulation industries. The financial and environmental impacts are summarised below.

| Results                                | Pulp and Paper                                   | Textile Processing           | Pesticides Formulation          | Total          |
|--|--|------------------------------|---------------------------------|----------------|
| No. of units                           | 4  | 4                            | 4                               | 12             |
| Waste minimisation options identified  | 197  | 119                          | 133                             | 449            |
| Options implemented                    | 72   | 51                           | 73                              | 206            |
| Options under implementation           | 37   | 36                           | 13                              | 86             |
| Total investment in waste minimisation | Rs. 9.5 million                                  | Rs.1.4 million               | Rs.0.4 million                  | Rs. 11.3 mill. |
| Monetary savings                       | Rs. 28.5 million <sup>a/</sup>                   | Rs.7.1 million               | Rs.0.2 million                  | Rs. 35.8 mill. |
| Pollution load reduced                 | Effluent vol. 32%<br>COD 31%<br>Total solids 40% | Effluent vol. 30%<br>COD 16% | Effluent vol. 74% <sup>b/</sup> |                |

a/ Including savings due to reduction in effluent treatment

b/ Represents expected reduction in toxic fugitive emissions and risks from health hazards

<sup>22/</sup> See UNIDO (1994).

In Tunisia, the Environmental Pollution Prevention Program of the United States Agency for International Development is funding a two-year programme in Tunisia. One of the first efforts there was a waste reduction audit in a lead-acid battery manufacturing plant to identify pollution prevention options that would reduce the quantity of toxic chemicals, raw materials and energy used in the manufacturing process. As a result of implementing preventive measures identified by the audit, the company will achieve the following:

- Reduce its capital investment cost for end-of-pipe equipment by at least 35 per cent and reduce the costs of treatment chemicals by at least 66 per cent
- Reduce employee exposure to lead dust
- Reduce energy and water use per unit output
- Reduce the amount of lead purchased
- Reduce lead-acid contaminated waste water
- Improve product quality by increasing service life.

To achieve these results, the plant is implementing 19 pollution prevention options that will save over US\$ 2.2 million in the first 24 months, for an investment of US\$ 0.4 million. Options include several no-cost actions, such as capturing spilled raw materials and reusing them in the production process, as well as actions that require the purchase of capital equipment (a liquid lead atomization mill) to reduce lead particle size and therefore waste.

A Czech-Norwegian cleaner production project, supported by the Norwegian Society of Chartered Engineers, has completed waste minimization studies at 11 plants. One of the plants is a producer of carpets with a yearly production of 1,500,000 square metres. Before the investigation, the plant disposed of 660 tons annually of solid/hazardous waste at a communal waste incinerator. As a result of implementing preventive measures, the plant achieved the following:

- Eliminated its expenditure for solid waste disposal, US\$ 1.3 million
- Reduced the amount of solid waste by 100 per cent, water use by 30 per cent and steam use by 10 per cent
- Improved the quality of the output by introducing changes in the dyeing process and process controls in spinning, twisting and weaving workshops and made new by-products from recycled materials
- Reduced off-site air pollution from solid waste incineration.

To achieve these results, the mill implemented 15 preventive measures at a total capital cost of US\$ 2,275,000. The total annual savings from these measures was US\$ 1.3 million, giving a payback period for capital investment of approximately two years.

The above examples illustrate the importance of utilising cleaner industrial technology in developing countries. The following recommendations are made in this regard<sup>23/</sup>:

- International organizations must do more to help developing countries to take advantage of cleaner technology. The activities of UNIDO, with its extensive experience with respect to information dissemination, training and education, the preparation of information materials and local capacity

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<sup>23/</sup> See UNIDO (1994).

building seem an appropriate way to help developing countries to take advantage of cleaner industrial technologies. These activities should be expanded, both on a bilateral and multilateral basis, and regional banks should be involved. An assessment should be done of the inputs necessary to build local capacity for the implementation of cleaner production outreach programmes in developing countries, including the inputs needed from developed countries. The assessment could lead to an international programme for cleaner production, taking into account regional needs and priorities.

- Multilateral and bilateral institutions need to encourage cooperation between the private environmental market sectors in developed and developing countries. The environmental market sector in developing countries is mainly confined to ordinary end-of-pipe hardware and software. Neither it nor the machinery sector in those countries is able to supply clean production hardware and software, which are often too expensive to import. Thus, local capabilities have to be built up, and for this, cooperation in the private sector so needed (licences, franchises etc.).
- There is need to expand life-cycle analysis and research on environmentally compatible products to increase the market demand for environmentally sound products from developing countries. An example of how this can be done is a life-cycle analysis of cotton garment production (Annex IV). There are two possible areas of investigation: What will be the impacts of life-cycle analysis and ecodesign on industrial and agricultural production in developing countries? How will the demand for environmentally sound products in industrialized countries affect the potential for new export markets for developing countries?

Annexe II, III, and IV give concrete actions for international cooperation in the leather industry, pulp and paper and textile industry respectively.

#### *Specific measures for counteracting adverse impacts of eco-labelling requirements*

Possible measures to alleviate fears regarding the impact of ecolabelling requirements on competitive advantages have been discussed at length in Section 5. The following paragraphs do not repeat these measures but give some additional ideas on how the recommendations can be implemented in practice, especially in collaboration with multi lateral development assistance.<sup>24/</sup>

- Since ecolabelling procedures are based on a cradle to grave approach, local industry associations should be supported in training their staff on the cradle to grave management style of production and marketing, with due consideration for local comparative advantages and resource availabilities.
- Assistance may be given to private sector associations in obtaining easy and inexpensive access to an internationally recognised certification scheme. This may be done for example by establishing certification offices in exporting countries. This would entail training of local inspectors by specialised organisations and certifiers from developed countries. An example of such a scheme is a pilot project sponsored by the French aid agency for the introduction of ecocertification for sustainable forestry in Africa in response to threats of boycott for tropical timber products from Africa.
- Improvement in information flows, transparency and consultations reduce costs of transition and adaptation to sustainable production and consumption patterns. International assistance to facilitate policy coordination and consultation procedures on a North-South and South-South basis is essential.
- The establishment of graduated qualification systems that indicate the level of "eco quality" of a product provide more accurate information to importers and consumers regarding the environmental

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<sup>24/</sup> These ideas were discussed and agreed upon at the OECD Workshop on Trade, Environment and Development Cooperation, October 1994, Paris. See Summary Report OECD/GD (95) 10.

friendliness of the product and also make market access easier for developing country exporters. This an important area where multilateral assistance would be required.

- Technical and institutional support for infrastructure facilities for testing, monitoring, certification and research and development are lacking or insufficient in a number of developing countries. Multilateral assistance should be coordinated closely with the private sector to provide these facilities.

## VIII. CONCLUDING REMARKS

What implication does the rather extensive review of the relationship between competitiveness and environmental policies have for the future? Evidence cited in the paper suggests that the link between the two is complex and that in general (except for certain small scale and/or resource intensive firms) the impact of environmental policies on compliance costs and therefore on competitiveness is insignificant.

The next two decades would, in all probability, show an even weaker correlation between stringency of environmental regulations and competitiveness, due to the following:

- firms that are unable to comply efficiently with environmental standards due to the lack of technological and managerial capability will eventually be forced out of the market and be replaced by more efficient firms in the same industry. The adverse competitive effects will not exist in the longer run;
- the wider application of environmentally sound technologies and production processes will generate economic and environmental benefits in the longer run that would compensate short run competitive effects. This is true even for smaller sized industries.

As mentioned in the paper, a possible exception to the above may arise due to present confusion and uncertainties regarding ecolabelling requirements by developed country importers. This would require concerted efforts to overcome information constraints and setting up of certification and testing centres in developing countries based on mutual recognition. Multilateral and bilateral assistance is of fundamental importance in this area in order to prevent eco labelling from becoming real barriers to trade and competitiveness.

Working on the premise that the economy as a whole will be able to maintain its competitive position in world markets despite stringent environmental regulations, it would be better to pose the competitiveness question in terms of environmental performance and profitability. The right question, as posed by Repetto<sup>25/</sup> is "whether firms whose environmental performance is better than their competitors within the same industry are more or less successful in the market place".

The real issue, especially for the forthcoming decade is therefore *the effectiveness of environmental expenditures in terms of reduction of pollution emissions per unit of output, and, in better health and safety conditions*. This calls for an integrated effort on the part of government and industry, the building blocks of which are:

- further promotion of cleaner production processes;
- the wider use of economic incentives as complements to command and control measures of pollution prevention;
- concern with social aspects of industrial and environmental regulation in terms of health and productivity impacts as well as in factory working conditions.

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<sup>25/</sup> See Repetto (1995), Jobs, Competitiveness and Environmental Regulation.



- **the use of environmental management systems by industry.** These are understood to include organizational structure, responsibilities, practices, processes and resources for implementing and maintaining environmental management. The latter comprises those aspects of the overall management function of an organization that develop, achieve, implement and maintain its environmental policy and objectives. Environmental management systems should enable organizations to achieve and demonstrate sound environmental performance by controlling the environmental impact of their activities, products and services, taking into account self-determined environmental policy and objectives. It also enables an organization to anticipate and meet growing environmental performance expectations, to ensure ongoing compliance with national and/or international requirements and to continually improve its environmental performance.
- **promotion of special programmes and support systems to improve the environmental performance of small scale enterprises.** This must be done by providing an enabling policy framework, technological assistance for adoption of environmentally sound technologies, and, institutional support.
- **building up technical capabilities and infrastructure for certification and testing** to overcome non tariff and market barriers arising from requirements such as eco labelling.

## Annex 1: Description of Case Studies: Impact of Environmental Regulations on Industrial Competitiveness

### A. *Leather*

Various studies<sup>26/</sup> have analysed the impact of environmental regulations on the leather industry. The most critical regulations that impact on costs of compliance are effluent and emission standards for water. In general standards are homogenous among industrialised countries but tend to be less stringent in developing countries. Firms comply to these standards either through changes in the composition of inputs and materials used or through technological improvements and treatment technologies. An assessment of compliance costs by Ballance et al indicates that in general capital costs will rise as a result of environmental compliance but the effect on overall costs (including operating costs) is less certain. Operating costs may increase on account of special chemicals required to treat pollutants as well as extra personnel costs and electricity costs. However more efficient new technologies may act as a neutralising factor. Rough estimates indicate that about half of the leather industries pollution load can be eliminated with relatively marginal investments. According to case studies, leather tanneries processing 100 tons of raw bovine hides per week can provide conventional effluent treatment for 200 ppm BOD and 30 ppm of suspended solids at a cost which is 3.2 percent of the sales value for full chrome side-upper leather<sup>27/</sup>. In the case of a sheepskin tannery processing 3000 pickled pelts per week the costs of treatment were 2.1 per cent of leather sales value.

#### *India*

The export oriented leather industry in India is faced with a European ban on the use of pentachlorophenol (PCP) for the conservation of leather and the use of dyes containing formaldehyde and benzidine. It is possible that packaging and labelling requirements would also come into effect fairly soon. Domestic regulations also require tanneries to install individual or common waste treatment plants. Estimated cost impacts of these measures range from 1.5 to 3.0 percent of finished product prices. However these vary for different units depending mainly on the size of the tannery. Smaller units with backward technologies, located in urban areas are the worst affected since they are unable to import equipment and processing chemicals to reduce effluents and maintain a quality product. These units are unable to capture a larger share of the market. More modernised tanneries with access to imported leather and a labour cost advantage are the least affected by regulations in external markets (mainly the European Union and Germany).

A study conducted by the German Development Institute in India has assessed that the Indian leather industry will be able to adjust to the PCP ban and cope with new product related eco standards despite problems encountered in the initial stages of the ban. The initial problems occurred mainly due to a lack of testing facilities to determine PCP content and the lack of PCP substitutes. These problems took a few months to resolve until testing centres were set up and Indian tanneries obtained information on where to get substitutes. In order to facilitate the import of substitutes (such as TCMTB and PCMC) the Indian Government reduced the import duty from 150 to 50 percent ad valorem<sup>28/</sup>. The same study has found that the support system for India's leather sector, in the public and private sector, is able to render services for export promotion, research and training. The main drawback lies in monitoring and enforcement functions.

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<sup>26/</sup> See UNIDO publication by R. Ballance et al, *The World's Leather & Leather Products Industry* (1993); R. Repetto: *Trade and Sustainable Development* (1994); J. Wiemann et al: *Ecological product Standards and Requirements as a New Challenge for Developing Countries' Industries and Exports*, German Development Institute (1994).

<sup>27/</sup> UNEP 1991 *Tanneries and the Environment*, Technical Report Series No.4, UNEP Industry and Environment Office, Paris.

<sup>28/</sup> Note that Argentina's leather industry did not face the initial problems as a result of the PCP ban to the same extent as the Indians because of the liberal trade policies already in place in Argentina which made imports more accessible.

## Chile

The Chilean Government has sought to reduce liquid wastes from soaking, tanning and finishing of leather products in response to a technical norm governing the discharge of waste products. This norm controls discharges into waste water collection systems and surface and underground watercourses and water bodies and has been in force provisionally since February 1993. Industry executives in the leather industry have responded to these measures by seeking viable and economically feasible solutions that have not adversely affected their competitive position.

The removal of potentially contaminating elements from the residues is done by using clean or low-waste-generating technologies and treatment technologies. An optimal solution resides in combining the two options, since even clean technologies cannot reduce contamination within the limits required by law, and further treatment of process sewage becomes necessary.

A study conducted by ECLAC and GTZ<sup>29/</sup> assessed the use of clean technologies in the soaking stage (specifically, hair stripping operations) and the tanning stage, using available information based on quotations and estimates provided by some tanneries. These stages generate much of the heavily polluted waste water, using sulphides (for hair stripping) and chromium (for tanning).

An economic assessment was made of three project alternatives for a model tannery. The first of these was to implement a chromium recovery plant. This assessment resulted in a high internal rate of return of 28.97%. The second alternative was to consider the implementation of a chromium recovery plant and the adoption of a different hair stripping method using less sulphides and involving recovery of the hair. This resulted in an even higher internal rate of return. In the third alternative, consideration was given to investment and the costs of implementing a sewage treatment plant. The results demonstrate the economic and environmental superiority of clean technology as opposed to treatment of waste generated.

The crucial point is that new and environmentally sound technologies can result in an overall reduction in production costs. The opportunities for leather firms to meet environmental standards, domestic or foreign, depend on the use of clean technologies that do not need end of pipe treatment (Ballance et al, 1993). Another factor of particular significance in the leather sector is economies of scale. The impact of economic policies on competitiveness will depend on the size of the firm and the degree of firm concentration. The probability of competitiveness loss is greater for small and medium scale units. However if tanning units are concentrated in a particular geographical area they will be better able to retain their competitive position despite comparatively stringent environmental regulations.

## B. *Pulp and Paper*

An UNCTAD study<sup>30/</sup> has found that due to trade liberalisation in Argentina a number of medium sized paper mills have been able to achieve improvements in environmental performance as a consequence of greater production efficiencies. This is manifested in fibre recovery and higher efficiency in the use of energy and water. An increasing use of recycled materials in the packaging industry (in response to foreign requirements) has resulted in reduced costs. Whereas primary effluent treatment units were installed by many firms, the same cannot be said for the more expensive secondary effluent treatment units. The same study has shown that smaller sized firms which generally use old equipment and out dated technologies find it more difficult to improve their environmental performance due to limited space and financial resources. Whereas the latter may be true in the case of adoption of new technologies, the scenario could be quite different if firms respond to stricter regulations by adopting waste minimisation options.

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<sup>29/</sup> Patricia Ilabaca, "Análisis económico de alternativas no contaminantes de curtiembres en Chile". Documento CEPAL, LC/R.1356, 22 de noviembre de 1993.

<sup>30/</sup> See Environmental policies, trade and competitiveness: conceptual and empirical issues: A report by the UNCTAD Secretariat (1995) A. Markandya: Reconciliation of Environmental and Trade Policies: Synthesis of Country Case Studies (1995).

In this context, project DESIRE undertaken by UNIDO and the National Productivity Council (NPC) in India<sup>31/</sup> has demonstrated that in the case of small scale agro residue based pulp and paper mills, savings from adopting waste minimisation options are almost double that of the initial investments required. For 72 feasible options, net annual savings of US \$ 672,000 were generated in response to an initial investment of US \$ 349,000. This implies an overall pay back time of 6 months on the investments. It becomes apparent from this exercise that even in the case of small scale industries, there is a possibility of improving environmental performance in response to stricter regulations without adding substantially to overall costs of compliance and production.

### C. *Textile Dyeing and Printing*

Textiles have also been affected by external regulations similar to those for the leather sector. Environmental impacts of the textile sector, including cotton cultivation, dyeing and printing are substantial and the possibility that stricter eco standards in the North will come into effect is very likely. In this section we discuss the impacts that this might have on compliance costs in the dyeing and printing industry.

Coloured waste water discharges from dyeing and printing options are the most visible form of pollution from this industry. Other environmental concerns relate to the use of toxic substances, high water and energy intensity of production, and air emissions of volatile organic compounds.

Results of the UNCTAD study in India have indicated that bans on the use of benzidine dyes will most likely double the cost of dyes, affecting the competitiveness of the dye stuff industry and the textile industry. This could be true if the substitutes are more modern dyes. In the case of traditional dyes, the additional costs of replacement will not be very high. The UNCTAD study also estimates that adhering to stringent product standards for a single blue dye would increase investment costs by \$13 million for some firms on account of upgraded technology, secondary treatment plants, and automation control equipment to monitor the area -to- fuel ratios and carbon di oxide emissions. However these costs will not be as high as those estimated by the above mentioned study, when techniques that lead to savings in inputs such as water, fuel, dyestuffs and auxiliary materials are applied. If this can be accomplished by optimising key stages in the production process, it would automatically result in reduced volume and toxicity of the effluent i.e. cleaner production. This in turn will manifest itself in reduced costs of effluent treatment and lessen the impact on competitiveness. UNIDO has been implementing these clean production programmes in the private textile industry to overcome industrialists' initial resistance to environmentally friendly production.

#### *Brazil*

UNIDO activities in Brazil have demonstrated considerable cost savings in the dyeing industry. In order to explain how these savings can be effected a brief description of the technical processes is warranted. Wet processing contains mainly chemical processes like desizing, scouring, bleaching, mercerising, dyeing, printing and resin finishing. These are supplemented by physical processes like washing, drying, heat setting, shearing, brushing, raising etc. The multitude of processes and their sensitivity to parameters such as time, temperature, pH-value etc. had made the dyeing industry heavily dependent on the experience and advice of dyestuff manufacturers and managers resulting in the application of recipes containing unnecessary and expensive amounts of dyestuffs and auxiliaries.

Since the 1960s however, with the introduction of computers, photospectrometers and process controllers, the development of the dyeing industry has become more scientific based. Optimised recipes developed through computerised colour matching have not only increased the repeatability of the dyeing process and reduced the consumption of dyestuff, energy and water but have also reduced the costs of dyestuff by 20 to 30 percent. Computerised process controllers and dosing apparatuses can reduce the consumption of salts, caustic soda and acids used for neutralisation up to 40 percent. Better control of temperature curves and fixating agents (together with modern dyestuff) are able to reduce the polluting effects of textile effluents. Alkali recovery plants can reduce the consumption of caustic soda by up to 90

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<sup>31/</sup> See UNIDO (1995): From Waste to Profits: Report of Project DESIRE (DEmonstrations in small Industries fro Reducing Waste), Draft Final Report (UNIDO).

percent and therefore decrease the toxicity of effluents from textile dyeing and finishing processes. Results from one company have shown that in the year 1994 the use of re dyeing was brought down from 7.4 percent to 0.7 percent and colour stripping and redyeing did not occur any more. The pay back period on investments in these processes is estimated as being 6 months at a minimum.

Apart from the application of clean production processes, waste minimisation options can also be adopted to reduce the costs of complying with more stringent environmental regulations. The DESIRE project undertaken by UNIDO in India has demonstrated in four small scale dyeing units that made an initial investment of Rs. 1.4 million in waste minimisation measures yielded monetary savings of Rs. 7.1 million, and a reduction of 30 percent in volume of effluent and 16 percent in COD load.

The above examples demonstrate that it is feasible and cost effective for dyeing units to adhere to environmental standards without necessarily corroding their competitive position, provided the right kind of technical and managerial approaches are adopted.

#### *D. Energy*

Perhaps the strongest evidence for export losses due to stringent environmental policies, both domestic and foreign, is to be found in the energy sector of some of the former centrally planned economies of Eastern Europe. A survey in Poland<sup>32/</sup> has shown that whereas market reforms and stricter environmental regulations have impacted positively on the environment, they have resulted in loss of international competitiveness because the prices of raw materials and energy have risen sharply in Poland. A large proportion of exports from Poland, e.g. electricity to the Czech Republic and Germany, are raw material and energy intensive. In large part the competitive advantage of Polish electricity exports is because it does not have to capture sulphur emissions. When desulphurisation of flue gas is introduced, the export of electricity may well become uncompetitive due to higher costs of generation (estimated by UNCTAD at 40%). This in turn will affect the export of other energy intensive goods such as plastics, fertilisers, organic chemicals and building materials. Similar considerations apply in other sectors such as coal mining where it is estimated that production costs will increase by 10 to 15 percent due to stricter environmental regulations on saline water discharges, and, exports in year 2000 will fall from 25 million tonnes to 10 million tons.

At the same time it should be noted that the introduction of environmentally sound technologies in response to stricter environmental standards will increase efficiency. In Poland this was found to be the case for example in the steel sector.

#### *E. Steel*

Industrial restructuring and market reforms may reduce capacity in the Polish steel industry but at the same time it will also reduce environmental damage by 70 to 80 percent. Remaining plants will be more efficient with production costs lower by \$20 to \$25 per ton (UNCTAD).

A similar experience is recounted in response to the Chilean Supreme Decree No.4 establishing maximum permissible levels of emissions. In periods of extreme environmental emergency and at the insistence of competent government authorities, when an industry exceeds the permitted levels it must suspend operations. In the case of heat treated laminated steel parts unit, the effects of a technological change in the fuel used in a heat-treatment furnace, from diesel oil to liquid gas were analysed. This change was made by a medium-scale metallurgical enterprise (35 employees) in the Santiago, Chile, metropolitan area, with the aim of achieving productive efficiency, as well as reducing contaminant environmental emissions and complying with the regulation established in Supreme Decree No. 4.

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<sup>32/</sup> See UNCTAD (1995).

An ECLAC study<sup>33/</sup> found that an appreciable decrease in particulate emissions could be observed, and this meant that the enterprise was complying with all the regulations in force and did not run any risk of being affected by restrictions on its activity. Moreover, a beneficial economic result was seen, with a positive marginal net present value and a highly attractive marginal internal rate of return (118%).

#### *F. Iron*

The same study has assessed the effects of a technological change which replaced a smelting process carried out in a cupola furnace by one performed in an electrical induction furnace, in a medium-scale iron foundry (35 employees) located in the Santiago, Chile, metropolitan area. This enterprise was forced to implement a technological change, motivated by the challenge of increasing the added value of its products and, at the same time, reducing the pollution levels, which exceeded the limits permitted by the legislation in force.

The change envisaged was designed to comply with the environmental regulation and to improve the competitiveness of the enterprise by enabling it to increase the value added to its primary product. It did this by switching from grey iron to nodular iron. The technological change reduced the emissions of gaseous and particulate contaminants owing to the characteristics of the smelting process when performed in an induction furnace. The decision to introduce the technological change had two interesting results: it significantly reduced the emissions generated by the industrial processes, so that the enterprise remained below the emission standard, and it improved the quality of the product obtained.

An economic assessment of the change, carried out by the Economic Commission for Latin America and the Caribbean (ECLAC)/Germany Agency for Technical Cooperation (GTZ) project, shows it to be a profitable investment, as revealed by a positive marginal net present value and a very attractive marginal internal rate of return (69.1%).<sup>34/</sup>

#### *Chile*

The same study also made an assessment of a medium-scale foundry (38 employees) located in Santiago, Chile, which introduced a technological change in order to reduce the pollution generated, as well as to achieve a more efficient operation. The enterprise smelted iron using a cupola furnace to obtain the metal. The resulting product is grey iron with a carbon content of 3% to 3.5%.

Foundries, especially those which use a cupola furnace, are industries which have a high pollution index because of gas releases and particulate emissions into the atmosphere. The enterprise in question was subjected to the suspension measures provided for in the new legislation (Supreme Decree No. 4), as its emissions greatly exceeded the permitted limits.

Because of this situation, the enterprise management opted for technological changes which, in addition to substantially reducing contaminant emissions, increased the efficiency of the process of smelting raw materials in the cupola furnace. Once the changes had been made, the enterprise was able to substantially reduce particulate emissions, reaching levels much lower than the limits permitted by the environmental sanitation agency. This ensured its smooth and uninterrupted functioning throughout the year. The economic benefits obtained by the enterprise were also significant: its production capacity increased and the costs of the process of smelting raw materials and obtaining cast iron decreased. These results were reflected in a highly positive marginal net present value for the project, coupled with an exceptionally high marginal internal rate of return of 93.16 percent.<sup>35/</sup>

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<sup>33/</sup> Liborio Bustos, "Transformación productiva ambientalmente sustentable en pequeñas empresas: el caso de dos fundiciones y una planta de tratamiento térmico en la Región Metropolitana (Chile)". Documento CEPAL, LC/R. 1250, 5 de febrero de 1993.

<sup>34/</sup> idem.

<sup>35/</sup> idem.

### G. Fisheries

Even before national environment norms were established, Chilean fisheries in the late 1970s faced environmental challenges from new demands of a more specialized market, requiring better-quality and more differentiated products, and from environmental pressures exerted by local communities where the processing plants were located.

#### Chile

In response to these challenges, a group of Chilean fishery enterprises belonging to the Association of Fish Meal Producers (CORPESCA) whose products are fish meal and fish oils had, in conjunction with a Norwegian enterprise (Hetland Process), developed a number of clean technologies that had met both environmental goals and goals of greater efficiency and profitability. In addition, the processes developed had enabled these companies to adapt better to market demands and obtain better prices, and, at the same time, to produce better-quality fish meals (speciality or "prime" fish meals) differentiated in accordance with the needs of their users (fish farming, poultry breeding, cattle finishing, food preparation, etc.). Previously, the final product (fish meal) had been sold in bulk to large-scale buyers, or traders.

Among the environmental benefits obtained from the new technologies are lower levels of particulate emissions in liquid effluents, fewer or no emissions of malodorous gases, energy savings and optimal use of raw materials.

Among the technical, economic and environmental achievements of the new technologies, mention can be made of the following:

- Primary and secondary centrifugation of the pressing liquid, so that fish solids and oil are obtained and the solid content of the effluent (liquid glue) is lowered by 7% to 25%.
- Decanting and filtering of discharge water, so that fish solids are obtained and the solid content of the effluent is lowered by less than 0.04% to 2%.
- Evaporation of liquid glue, so that soluble protein concentrates are obtained which are added to the fish meal, and the solid content of the effluent is eliminated.
- Deodorizing of drying gases; in an initial stage, the water vapour level was lowered and the volume and temperature of the gases was reduced by cleaning them with sea water.
- Gas emissions into the atmosphere were totally eliminated through a complete technological overhaul of industrial steaming, drying and evaporation equipment and the use of additional equipment.
- Sanitation and health programmes in the plants, blocking the development of germs that accelerate the decomposition of raw material and increase the emission of odours in the process.
- Computer control of operating speeds so as to optimize drying, reducing the emission of odorous gases.
- Optimization of deodorizing equipment through the use of linings that improve gas exchange and lower emissions.
- Application of an integrated steaming, drying and evaporation system that uses residual drying vapours as a heating method, and use of a computer-controlled thermodynamic chain for evaporation and steaming.

In addition to the other results mentioned, the following was achieved:

- An energy saving of 25% to 28%.

- Production of a more digestible fish meal with a higher percentage of protein and lysine.
- An increase of 15% to 29% in utilisation of raw materials.

The obvious advantages of the new technologies and industrial prototypes have enabled them to be sold to such countries as Peru, Denmark, Norway and Japan. In addition, a kind of technological dependency has been overcome, since previously all equipment was purchased in the developed countries. Moreover, a promising technological link has been established between two countries at very different levels of development (Chile and Norway).<sup>36/</sup>

#### **H. Food Processing**

In contrast to the positive experience cited above in case of Chilean fisheries, is the case of meat processing in Zimbabwe. The UNCTAD study cites examples where it is felt that foreign standards are having an adverse effect on exports of ostrich production and beef to the European Union and Australia. Quarantine regulations and costly blood tests would make exports of live birds and meat less competitive. Phytosanitary standards for the export of beef to Europe require European importers to inspect all produce before it leaves the exporting country. Zimbabwean exporters feel this will raise their costs substantially and dissuade them to find export markets.

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<sup>36/</sup> See, Ernesto Ezquerro R., "Empresas líderes en desarrollo, aplicación y difusión de tecnologías ambientalmente racionales en América Latina: el caso de Maestranza Iquique S.A - Hetland Process y empresas pesqueras asociadas a Corpesca, Chile". Documento CEPAL, LC/R.1152/Rev.3, 18 de marzo de 1994.



## Annex II

Leather and tanning industry: areas for international cooperation

| Process                    | Activity  | Equipment   | Chemicals | Advisory services |
|----------------------------|---|---|-----------|-------------------|
| Preservation               | Use of green hides from abattoirs without the need for temporary preservation   |   |           | x                 |
|                            | Use of safe biocides in curing hides and skins and wet blue leathers  |   | x         | x                 |
| Beamhouse                  | Partial salt elimination by using a drum-type shaker  | Special drums   |           | x                 |
|                            | Green fleshing  | Modified fleshing machine                                 |           | x                 |
|                            | Hair-saving, unhairing-liming, especially enzymatic unhairing of skins  | Eco-drum, instruments for process control                 |           | x                 |
|                            | Ex-lime instead of ex-wet blue splitting  | Highly accurate splitting machine                         |           | x                 |
|                            | Ammonium-free CO <sub>2</sub> deliming for light pelts, combined with the use of ammonium-free bases  | Specially equipped drums, instruments for process control |           | x                 |
| Tanyard                    | Use of biodegradable surfactants instead of organic solvents; reuse of solvents   |   | x         | x                 |
|                            | Limited direct recycling of chrome floats   | Specially equipped drums, instruments for process control |           | x                 |
|                            | Chrome recycling with precipitation   | Filter press, instruments                                 |           | x                 |
|                            | Use of high chrome exhaustion systems primarily for lime-splitting hides  |   | x         | x                 |
| Wet and dry finishing      | Use of heavy metal-free and benzidine-free dyes   |   | x         | x                 |
|                            | Use of non-halogenated fat liquors  |   |           |                   |
|                            | High-level exhaustion of syntans, dyes and fat liquors  | Instruments for process control                           | x         | x                 |
|                            | Use of water-based finishes; at least base and middle coats are made of aqueous polymeric dispersions and contain safe cross-linking agents | Advanced spraying equipment                               | x         | x                 |
|                            | Use of roller coating technique   | Roller coater   | x         | x                 |
| Utilization of by-products | Manufacture of glue, gelatin, animal feed, fertilizer etc.  | Processing equipment                                      |           | x                 |

Source: UNIDO, Industrial Sectors and Environment Division, Agro-Based Industries Branch, 1994.

## Annex III

**Pulp and paper industry: areas for international cooperation**

| Process   | Activity  | Equipment   | Chemicals | Advisor/<br>services |
|---|---|---|-----------|----------------------|
| Preparation of fibrous non-wood raw materials                       | Preparation and de-dusting system   | x   |           | x                    |
|   | Dry and wet cleaning of straw   | x   |           | x                    |
| Pulping   | Optimization of pulping conditions for non-wood fibrous raw materials                           |   | x         |                      |
|   | Process control instrumentation for digester  | Pressure and temperature control                      |           | x                    |
|   | Use of weak black liquor in the digester  |   |           | x                    |
|   | Use of blow tank and recovery of blow steam   | x   |           | x                    |
| Washing/separation of black liquor/<br>screening/pulp fractionation | Use of belt washer for countercurrent washing instead of potcher (belt washer needs more space) | Belt washer with 5-6 countercurrent stages            |           | x                    |
|   | Screw press or other type for removal of liquor before washing                                  | x   |           | x                    |
|   | Fibre fractionator to remove fines  | x   |           | x                    |
| Bleaching   | Better control of bleaching (using chlorine and hypochlorite)                                   |   |           | x                    |
|   | Change from calcium hypochlorite to sodium hypochlorite   | x   | x         | x                    |
|   | Elemental chlorine-free bleaching (ECF)<br>Total chlorine-free bleaching (TCF)                  | Mixers, bleaching towers, washers                     | x         | x                    |
|   | Process control instrumentation for each bleaching stage  | On-line pH/temperature/consistency control            |           | x                    |
| Stock preparation and paper machine                                 | Refining of non-wood pulps  | Adequate plate pattern of refining elements           |           | x                    |
|   | Control of freeness of refined pulp   | Schopper Riegler or Canadian Standard Freeness Tester |           |                      |
|   | Consistency control of the pulp being refined   | Consistency controls                                  |           | x                    |
|   | Better control of operating variables of centrifugal cleaners                                   |   |           | x                    |
|   | Better control of blending various pulps  |   |           | x                    |
|   | Consistency control in the paper-machine approach system  | Consistency controls                                  | x         | x                    |
|   | Better control of chemical additives (retention aids, fillers etc.)                             |   | x         | x                    |
|   | Improve headbox and flowspreaders   | x   |           | x                    |
|   | Improve foils and vacuum boxes in paper machine   | x   |           | x                    |
|   | Improve press section of paper-machine  | Use 3 nips press instead of 2 nips press              |           | x                    |
|   | Improve drying section and condensate removal and reuse of condensates                          | x   |           | x                    |
|   | Improve shower nozzles  | x   |           | x                    |
|   | Close white water system  | x   |           | x                    |
| Waste paper treatment   | Improve waste paper treatment system (pulper, screens, cleaners)                                | x   |           | x                    |
|   | Simple methods for de-inking  | x   | x         | x                    |

Source: UNIDO, Industrial Sectors and Environment Division, Chemical Industries Branch, 1994.

## Annex IV

**Cleaner production in the textile industry in developing countries**

There is a growing interest on the part of consumers, authorities and companies in the environmental impacts of garments. Several retail companies in the Netherlands have introduced green garments into their collections. The garment production chain is primarily located in developing countries (for example, India, Thailand, Indonesia and China) and newly industrializing countries. In the production chain for cotton garments, the following steps can be distinguished:

| <u>Process</u>                                  | <u>Environmental issue</u>                                     | <u>Cleaner technology</u>   |
|---|--|---|
| Cotton growing<br>fertilizers                   | Use of pesticides, fungicides etc.                             | Biological pest treatment and   |
|   | Use of fertilizers   | Integrated pest management (IPM)  |
| Spinning/weaving/<br>bleach<br>treatment/dyeing | Water pollution (dyes, salts,<br>detergents, bleaching agents) | Bleaching with peroxide. Biological<br>clean up reducing water consumption. |
|   | Sizing and desizing agents                                     | Biostoning. Use of more efficient<br>bi-reactive dyes.                      |
|   | Formaldehyde emissions   |   |
|   | Energy and water use   |   |
| Garment industry                                | Wastes   | Optimize material use   |
|   | Use of accessories   | Accessories of natural materials  |
| Distribution                                    | Transport  | Reduce/optimize transport<br>No air transport                               |
|   | Packaging  | Reduce packaging material   |
| Usage   | Washing and cleaning   | Use phosphate-free detergents<br>Use CFC-free dry-cleaning agents           |
| Disposal  | Waste  | Reuse garments or fabrics   |

The most serious environmental impacts occur in cotton growing (pesticide and fertilizer use) and in textile treatment/dyeing. As these steps are mainly located in developing countries, these countries will be confronted with an increasing demand for environmentally sound products and semi-manufactures. To improve the environmental performance of the textile industry in developing countries, process adaptations will be required, including the following:

|                          |  |
|--------------------------|--|
| Clean cotton growing     | Biopesticides/Integrated Pest Management                               |
| Textile dyeing/finishing | Advanced bi-reactive dyes  |
|                          | Enzymes for desizing, biostoning and/or bleach clean-up process steps. |
|                          | Use of peroxide instead of chlorine.                                   |

These products and technologies are available in developed countries, which creates new market opportunities for the exports of software and hardware to developing countries. The growing demand for environmentally sound products can be a driving force for cleaner production in developing countries. On the short term this potentially leads to a growing force for cleaner production in developing countries. On the short term this potentially leads to a growing export of cleaner technologies (both software and hardware) from developed countries to developing countries.

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