

# CEPAL

## REVIEW

NUMBER 58

APRIL 1996

SANTIAGO, CHILE

GERT ROSENTHAL

*Director of the Review*

EUGENIO LAHERA

*Technical Secretary*



UNITED NATIONS

## CONTENTS

<b>Aníbal Pinto Santa Cruz</b> <i>Gert Rosenthal</i>	<b>7</b>
<b>Social policy paradigms in Latin America</b> <i>Rolando Franco</i>	<b>9</b>
<b>Virtues and limitations of census maps for identifying critical deficiencies</b> <i>Rubén Kaztman</i>	<b>25</b>
<b>Central America: inflation and stabilization in the crisis and post-crisis eras</b> <i>Hubert Escaith, Claudia Schatan</i>	<b>35</b>
<b>The State, business and the restoration of the neoclassical paradigm</b> <i>A. Barros de Castro</i>	<b>53</b>
<b>Globalization and loss of autonomy by the fiscal, banking and monetary authorities</b> <i>Juan Carlos Lerda</i>	<b>65</b>
<b>The macroeconomic context and investment: Latin America since 1980</b> <i>Graciela Mognillansky</i>	<b>79</b>
<b>Property rights and the rural land market in Latin America</b> <i>Frank Vogelgesang</i>	<b>95</b>
<b>Mexico: the plan and the current situation</b> <i>David Ibarra</i>	<b>115</b>
<b>Foreign trade and the environment: experiences in three Chilean export sectors</b> <i>Imme Scholz</i>	<b>129</b>
<b>The competitive challenge for Brazilian industry</b> <i>João Carlos Ferraz, David Kupfer and Lia Hagenauer</i>	<b>145</b>
<b>Indicators of fiscal policy: design and applications for Chile</b> <i>Ricardo Martner</i>	<b>175</b>
<b>ECLAC and the sociology of development</b> <i>Enzo Faletto</i>	<b>191</b>
<b>Guidelines for contributors to CEPAL Review</b>	<b>207</b>

# Foreign trade and the *environment: experiences* in three Chilean *export sectors*

---

**Imme Scholz**

*Researcher, German  
Development Institute,  
Berlin.*

This article presents the findings of research into the environmental adaptability of Chilean export enterprises in a number of sectors: wood, woodpulp, furniture manufacture, and salmon and oyster farming. The study was prompted by the ecological product and process requirements set by Germany and Europe in general, which are exerting pressure on those sectors to adapt. After examining the context offered by Chile for this adjustment process (section I), the article looks at these requirements and their status in the multilateral GATT regime (section II). The article then sets out the management and adjustment requirements which environmental reforms impose on the economic, political and social agents at the various levels at which they operate. These considerations form the analytical background to the study, in as much as the exposition of the problem calls for the adoption of a systemic competitiveness approach as a heuristic framework in order to define more precisely the demands placed on operators at the macro, meso and micro levels (section III). It then analyses in greater detail the environmental adaptability of enterprises in the sectors surveyed (section IV), and finally presents the conclusions of the study (section V). At the enterprise (micro) level, the pursuit of international competitiveness standards is encouraging major technological and organizational innovation and learning processes, while at the meso and macro levels (enterprise support structure and State regulatory activity), there are deficiencies that restrict enterprises' adjustment capability, thus hindering the effective economic exploitation of the dynamic comparative advantages connected with the sustainable management of Chile's natural resources.

# I

## Introduction

Export-oriented enterprises in developing countries are faced with an ever increasing number of environmental requirements concerning their products and production methods (Scholz, 1993; Wiemann *et al.*, 1994). These new requirements are causing enterprises to engage in complex learning processes in the areas of environmental management, technology and organization, which may entail simple or very complicated adjustments in product lines and production process stages. The experiences of the OECD countries indicate that the success of these learning processes depends not only on the presence of innovative enterprises but also on a macro-economic, political, legal and administrative context that provides incentives for making production and products increasingly environmentally compatible, and on an enterprise support structure whose institutions (basic and further training, research and technology, funding, and commercial and environmental policy) contribute to the search for appropriate solutions.

Chile is one of the most suitable countries for an analysis of environmental adaptation processes viewed within this conceptual framework. There are four reasons for this:

(i) In 1973, the import substitution strategy was replaced by an economic model which, with its clear focus on competitiveness and the global market, provided the impetus for the development of a strong and dynamic export sector that today accounts for about one quarter of GNP.<sup>1</sup> In the key areas of the export sector, the free trade regime has given rise to the emergence of an entrepreneurial sector trained to explore the product and process requirements of the global market and skilled in adapting the way its enterprises are organized to meet those requirements.

□ The study on which this article is based was conducted by a working group of the German Development Institute, Berlin, composed of the author and Karola Block, Karen Feil, Martin Krause, Karolin Nakonz and Christoph Oberle. The group was greatly assisted by ProChile, the State export promotion agency. For an exhaustive report on the research and its findings in each of the sectors surveyed, see Scholz, Block, Feil, Krause, Nakonz and Oberle (1994).

<sup>1</sup> In 1993, GNP was US\$43,700 million and exports totalled US\$9,400 million (bfai, 1995).

(ii) To a large extent, the international competitiveness of Chilean export enterprises continues to depend on static advantages of location, that is to say low labour costs, favourable climatic conditions and abundant natural resources. However, the phase of extensive exploitation of this source of competitiveness is beginning to reach its limits. One limit is set by the demand for wage increases for the broad mass of the labour force, a demand that has been growing since the return of democracy in 1990 and whose fulfilment would appear to be feasible given the country's sustained economic growth. The other limit relates to the environmental costs connected with the success of the new development strategy: the accelerated growth and dynamic development of the new, natural-resource-based export sectors – primarily fisheries, forestry and market gardening – carry the risk of depletion of certain natural resources and of high levels of pollution of the air, water and soil.<sup>2</sup>

(iii) A forward-looking economic policy must aim to fulfil two purposes: firstly, it must in the long term ensure the international competitiveness of the Chilean economy by extending social growth projections; secondly, it must reduce the environmental impact of production patterns. It will therefore be necessary to increase the creation of added value, boost productivity and develop more sophisticated and less natural-resource-dependent sectors. If these two purposes are pursued, outward-oriented industrialization supported by dynamic raw-material-based export sectors (the “second stage” of the export model)<sup>3</sup> could provide

<sup>2</sup> Given the regional distribution of the new export sectors, all the environmental problems – with the exception of overfishing of inshore waters – have a marked regional dimension: the degradation and felling of native forests, which endanger bio-diversity, are concentrated in the south of the country; pollution of the soil and water resources by single-crop farming mainly affects the regions that specialize in tree, vegetable or fruit growing; Santiago and other urban centres have serious air pollution, traffic, transport and waste disposal problems (Sanhueza, 1992). Concerning the regional distribution of the new economic sectors and their environmental impact, see Dockendorff *et al.* (1990), quoted by Maggi (1994).

<sup>3</sup> See Madrid and Ominami (1989), Mármora and Messner (1992), and also Messner (1993) on developing competitiveness potential in the Chilean wood export sector.

leeway for wage increases and keep Chile on its technological development course. The prospects for reforming the Chilean economy in an environmentally favourable manner lie in the synergistic effects that can be achieved by coupling measures to promote productivity and efficiency with protection of the environment and natural resources at both the enterprise and the sectoral levels.<sup>4</sup>

(iv) Since 1990, when the military regime came to an end, the first elements of environmental controls at the State level have been emerging.<sup>5</sup> Public debate on this issue indicates relatively broad environmental awareness. However, the reforms are at the same time hindered by three factors characteristic of developing countries that have abandoned the import substitution strategy with its high level of State intervention. Firstly, predominant neo-liberal thinking makes State intervention seem inefficient in comparison with market forces and obscures the positive

functions of government management. However, State action is not in fact limited to establishing and strengthening an institutional framework conducive to the free development of the individuals and sub-systems comprising a society; rather, among other things, it coordinates different or divergent interests for the common good and gives consistency to the different sectoral policies. Secondly, the trimming of the State apparatus has led to a reduction in management, planning and monitoring capacities. Thirdly, this situation has increased the influence of powerful interest groups in the formulation, implementation or blocking of parliamentary initiatives, with the result that the solving of environmental problems is obstructed by private economic interests.<sup>6</sup>

Chile therefore has need of entrepreneurial, sectoral and politico-administrative reforms in a context which, despite the limitations mentioned earlier, is politically and economically favourable.

## II

### Environmental requirements for products and processes

Ecological product requirements are assuming increasing importance in Germany and other European countries. There are three reasons for this phenomenon: firstly, consumers are now better informed of the pollutant or harmful properties of commodities and are thus guided by environmental criteria when

making purchase decisions; secondly, this more vigilant attitude on the part of the consumer increases the pressure on the legislature to avert the potential dangers which toxic substances represent for the environment and human health; thirdly, industry and commerce have detected this change in consumer at-

<sup>4</sup> More efficient use of raw materials and energy helps to reduce enterprise costs and makes it possible to manage resources with greater care, thus facilitating, among other things, their regeneration and reducing energy consumption and consequent emissions. No answer has yet been found to the problem of limiting the outright consumption of natural and environmental resources that goes hand in hand with industrialization and the spread of Western consumption patterns in developing countries (sufficiency as opposed to efficiency).

<sup>5</sup> In 1990, the National Environmental Commission (CONAMA) was established with responsibility for coordinating and designing environmental policy. The development, implementation and monitoring of environmental policy at the sectoral level continues to be the responsibility of the ministries concerned. The first sectoral environmental law was the Fisheries Act, passed in 1991, which established a quota system for the exploitation and regeneration of fishery resources. The Basic Law on the Environment, adopted in 1994, serves as a basis for other laws, decrees

and regulations on protection which are still pending, and also regulates the introduction of mechanisms such as environmental impact assessment, liability for environmental damage, and taxes, levies and licences. The laws and other statutory measures are guided by the principle of prevention and the "polluter pays" principle (Chile, 1994). In CIPMA (1992), a general idea is given of the debate in Chile on the regulatory models, instruments and fields of action that make up environmental policy.

<sup>6</sup> Gómez-Lobo and Jiles (1993, pp. 352-357) describe the negotiations concerning the Fisheries Act and examine the powerful lobby of the major fisheries enterprises in support of the establishment of regional boards to fix catch limits, rather than having that task carried out by the official agencies in the sector. These boards are an instrument through which enterprises can obstruct the establishment of a system of individual marketable quotas capable of regulating the extraction of fishery resources and greatly limit the freedom of action of official agencies to promote the efficient management of those resources.

titude, and are gradually adapting their production and input purchasing. These adjustment measures vary greatly in scope, ranging from merely using environmental marketing opportunities to examining the environmental impact and damage due to production with a view to ultimately eliminating them. This latter option is the one chosen by pioneering enterprises that have recognized the competitive advantages of a higher environmental profile and wish to exploit them.

Ecological requirements relating to products take a number of forms.<sup>7</sup> The mandatory legal requirements regarding maximum values, regulations concerning use or, as applicable, prohibitions on dangerous substances provide safeguards for the consumer and in the area of health and safety at work and also serve to protect the air, soil and water from environmental poisons.

At the same time, increasing use is being made of optional instruments to encourage enterprises to manufacture products with a lower environmental impact. These instruments include industrial standards that are agreed between manufacturers and users on the basis of technical criteria and which are now beginning to incorporate some environmental features. Other voluntary instruments are the marketing of products with an ecological seal of approval (OECD, 1991; Jha, Vossenaar and Zarrilli, 1993) and voluntary undertakings by industry not to use or produce dangerous substances.

Ecological product requirements also have an impact on how goods are manufactured. This is important because enterprises that are obliged to make

short-term environmental adjustments in order to be competitive cannot avoid the need for wide-ranging structural changes in the medium and long terms. The environmental assessment of a product is usually based on an analysis of its complete life cycle (UBA, 1992). This includes not only manufacturing methods but also the stages preceding and subsequent to production (inputs, transport, use and disposal). Thus, in order to reduce the environmental impact of a product's properties it may be essential to restructure the entire value-added chain and not merely make the necessary adjustments to production processes and methods. The environmental policy for the business sector is reinforcing this trend with a set of incentives to encourage enterprises to undertake environmental stewardship themselves by increasing their technological and organizational capacity to solve related problems. This arsenal includes process regulations to prevent environmental pollution loads, optional instruments such as environmental impact surveys and participation in environmental management schemes and environmental audits.<sup>8</sup> This has unavoidable repercussions for input suppliers: enterprises that have environmental surveys or audits carried out are increasingly insistent that their subcontractors comply with ecological process requirements. Enterprises that lead the way in ecological matters are concerned with the environmental performance of a new product and the different stages in its manufacture from the moment they begin to develop it, and this in turn generates new requirements in redefining product functionality, quality and durability.

### III

## Pressure for environmental adjustment and systemic competitiveness

Improving the private sector's environmental adaptability is a considerable challenge to the technological and organizational learning capacity of exporting enterprises in developing countries. Added to this is the fact that the global economic context and, conse-

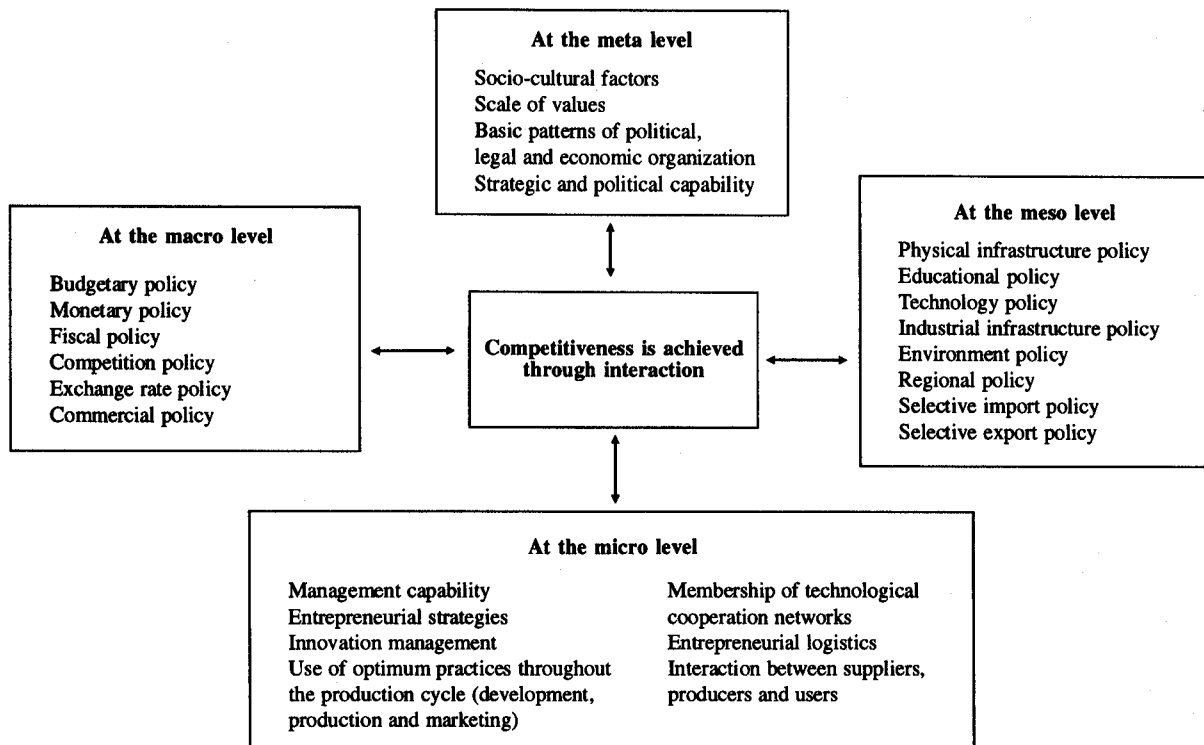
quently, the factors that determine international competitiveness have undergone structural changes and become more complex. The concept of systemic competitiveness (Esser, Hillebrand, Messner and Meyer-Stamer, 1994; Hurtienne and Messner, 1994)

<sup>7</sup> Bennett and Verhoeve (1994) give a detailed description of environmental requirements in the European Union, the United States and Japan.

<sup>8</sup> Karl (1993) and Hunt and Johnson (1993) review the European Union directive on environmental audits (see European Commission, 1993). Welford (1993) referred to the limits of such environmental management systems at the enterprise level.

FIGURE 1

## Factors that determine systemic competitiveness



makes it possible to distinguish between the levels at which systematic and coordinated efforts must be made and also to identify the social agency groups involved (figure 1). This concept highlights the urgent need to establish coordinated and interlinked structures between the different levels of action and between the social agency groups.

If the international competitiveness of the economy is to be kept within the limits of its ecological sustainability, operators must take up the challenge of an increased need for interaction and coordination at the micro, meso and macro levels, by generating new management tools and a new institutional fabric that can direct the learning and decision-making processes towards a common goal. It is therefore clear that both the environmental requirements of competitiveness and the model, albeit rather schematic, set out here to achieve competitiveness are extremely exacting, entail a number of premises and may thus give rise to quite a few difficulties. In a context that is dominated by competition, the problem is not only one of developing coordinated and interlinked structures. The negotiations that have to be undertaken on development priorities and objectives and the way in

which the hoped-for benefits of economic prosperity will be distributed are a major challenge in countries whose weak institutional fabric hampers the full participation and protection of the interests of all sectors of the population.

Like the new demands that maintaining competitiveness places on the organizational and learning capacity of operators at the different levels of action, the strategy for environmentally sustainable industrial development inevitably entails complex processes of learning and adjustment in social, technological and institutional terms. The macro level assumes an important role when general conditions are being created to make economic development environmentally compatible (environmental legislation and optional and economic instruments). The State agencies must develop the necessary environmental instruments and establish the legal premises for a forward-looking environmental policy, for its objectives and for the necessary government intervention, all of which requires preliminary dialogue with the social agencies (enterprise associations, trade unions, scientific institutions and environmental organizations) in order to ensure the validity of these measures. This is an important pre-condition for

mobilizing the professionalism and creativity of enterprises and applied research centres in the search for solutions that are both practical and environmentally sound. The application of economic instruments that use the mechanism of prices to change behaviour and improve efficiency also requires wide-ranging agreement between the social, political and economic agents on the extent of the objectives to be achieved using such measures.

At the micro level, the aim is to increase the readiness and capacity of enterprises to develop active strategies to boost their environmental efficiency that go beyond the minimum levels of environmental and natural resource protection. Eco-efficient enterprises are working to reduce the consumption of energy and natural resources in their production methods, replace pollutant inputs or materials, introduce clean products and technologies and recycle raw materials or products (Schmidheiny and Business Council for Sustainable Development, 1992).<sup>9</sup>

The importance of the meso level is further accentuated by the demands that structural environmental reforms place on the organizational and learning capacity of government institutions and civic bodies. This relates not only to the formulation of sectoral policies but also to the active role that institutions at this level can play in establishing and strengthening technological capability.<sup>10</sup>

In the design of sectoral policies and the search for specific solutions at the meso level, it is advisable to agree upon environmental measures and pro-

grammes with the social sectors and groups involved in order to give them greater validity and make them more easily acceptable, thus helping the pursuit of policies and solutions. Even though it seems trivial to say so, this step is an important one, both for the legislator—whose obligation is to learn to negotiate with the relevant interested groups inside and outside parliament and to justify interventions—and for the competent government institutions.<sup>11</sup> Against this background it would be reasonable to encourage decentralization efforts in order to strengthen regional or local problem-solving capabilities. This is particularly important in the developing countries, where the monitoring agencies are not strong enough to guarantee the effectiveness of legal instruments in practice and where the democratic structures are often too weak to enable those involved to play a full part in formulating the necessary instruments and measures.

The strengthening of enterprises' technological capability is a key requirement for improved control of the environmental impact of production processes and products. Consequently, technological institutions and the education system must be in a position to offer the necessary skills, techniques and guidance to enterprises wishing to introduce environmental innovations when export markets or the legislature so require. Institutions involved in the development of small- and medium-scale industry, technology transfer and export promotion must include the environmental dimension in their consultancy and promotional activities from the outset.

## IV

### Environmental adaptability of certain Chilean export sectors

Chilean exporters too have to cope with environmental requirements imposed on their products and production methods by markets, particularly in Europe. In order to evaluate the environmental adaptability of the sectors in question, it is useful to classify them

into two categories: natural-resource-based sectors, whose international competitiveness depends increasingly on their ability to apply sustainable management methods, and manufacturing sectors, whose task is to improve the environmental compatibility of

<sup>9</sup> North (1992) gives us a general outline of the possibilities for incorporating environmental criteria in enterprise management.

<sup>10</sup> For a definition of technology and technological capability, see Hillebrand, Messner and Meyer-Stamer, 1994, pp. 3-8.

<sup>11</sup> The fact that the adoption of the Native Forests Act in Chile is already five years behind schedule indicates how hard this task can be in a situation dominated, on the one hand, by the newly regained scope for democratic action and, on the other, by neo-liberal and anti-interventionist ideas.



their production methods and their products in an effort to achieve levels comparable with those in the industrialized countries.

### 1. Natural-resource-based sectors

Enterprises in these sectors have a high adjustment capability. The product and process requirements are relatively achievable and easy to satisfy owing to their low level of technical complexity.

#### a) *Salmon and oyster farming*

In this sector, both the European Union and the United States impose rigorous hygiene and health standards on enterprises and products<sup>12</sup> and they also demand high standards of breeding water quality. Compliance with these requirements has to be supervised and certified by official agencies recognized by the European or United States authorities. The high adaptability of enterprises in this new sector stems from four key factors: (i) they were established from the outset to supply export markets, so that their survival has always depended on compliance with external requirements; (ii) the enterprises have resources to meet the costs of environmental adjustment since they are solvent, have reserve assets and achieve large profits owing to their high growth rates and accelerated expansion in foreign markets; (iii) the requirements relating to water quality can be met without any prior efforts on the part of the enterprises, since Chile has abundant expanses of inland and coastal waters that are free from pollution of human origin; and (iv) in the employment market, the enterprises can supply their needs for trained and specialized workers as well as for cheap, unskilled labour.

<sup>12</sup> Interviews were conducted with 10 medium-sized modern enterprises, all of them exporters and most of them with a foreign holding. In virtually all cases, enterprises in this sector are split into two sections: the farming centre and the processing plant. The processing of salmon involves only harvesting, cleaning, sometimes filleting, packaging and freezing or refrigeration. Oysters only need to be packed for refrigerated transport. The relatively uniform structure of the enterprises in the sector made the survey fairly representative. Interviews were also conducted with all the major institutions at the meso level, including Fundación Chile, the National Fisheries Service (SERNAP), the Fisheries Development Institute (IFOP) and the sectoral associations.

There is, however, a fifth key factor to account for the high adjustment capability at the macro level: the strategy adopted to develop this sector included from the beginning the creation of an institutional framework to promote cooperation between enterprises in the sector and applied-research, information, technology-transfer and quality-control institutions that would help them survive in the export markets.<sup>13</sup> In other words, since the time of their establishment, these enterprises have had positive experiences with organizational methods that have enabled them to learn jointly and combine their efforts to enhance the general level of quality and performance in the sector.<sup>14</sup>

It is therefore to be hoped that this sector will be able to respond appropriately to the increasing pressure (external or internal, as the case may be) to remedy the environmental damage caused by aquaculture where measures can be taken at the enterprise level. This damage is due primarily to water pollution from increasingly intensive farming and from the harvesting waste, and it also has an adverse impact on local or regional fauna. None the less, the sector will be unable to solve the problems caused by effluents and other sources of harmful substances (such as sewage, agriculture and waste tips) that may affect its production. To keep breeding water pure, enterprises will have to rely on the promulgation of sectoral regulations and on the effectiveness of regional or local authorities that are responsible for monitoring compliance and are in a position to coordinate the action of the bodies involved in a given region.

#### b) *Forestry sector*

European wood importers are inquiring with increasing insistence into the methods by which the forests or plantations that produce this natural resource are managed. Consequently, the main environ-

<sup>13</sup> Fundación Chile played an important role in this process (Schmidheiny and Business Council for Sustainable Development, 1992, pp. 326 *et seq.*).

<sup>14</sup> The salmon industry association awards a quality seal of approval, which covers all export market requirements and is recognized by importers.

mental challenge facing the forestry sector in Chile is to introduce sustainable management methods in order to reduce the environmental impact of the plantations and to preserve the native forest.<sup>15</sup>

The pace of growth in the forestry sector began to quicken dramatically in 1974 with the promulgation of decree-law 701, the result being that Chile now has the world's largest expanse of pine plantations.<sup>16</sup> The key measure was to re-privatize the forests and to offer a guarantee of ownership that would open up secure prospects of a forestry industry necessarily oriented towards long-term profits. Also, subsidies and tax rebates were granted in respect of 75 per cent of reforestation and forestry management costs (Vincent and Binkley, 1992, p. 113). These specific incentive measures have helped to turn Chile's comparative natural advantages in this sector into sources of competitiveness.<sup>17</sup>

As a result of these incentive measures, 90 per cent of forestry production now comes from plantations and only 10 per cent from native forests. The plantations are single-species, cover vast areas (85 per cent pine and the rest eucalyptus) and are generally of a very high density. They produce the typical environmental effects of monoculture: unilateral nutrient consumption, reduction in soil fertility with the consequent danger of excessive fertilizer use; and plantations highly vulnerable to pests and diseases, with the risks inherent in the use of pesticides that

pollute water resources. One positive contribution made by plantations is to help combat erosion,<sup>18</sup> which generally affects previously wooded areas that have undergone desertification as a result of over-farming.<sup>19</sup>

Large-scale enterprises in the sector have been introducing modern forestry management methods since the 1980s. This modernization has helped to improve enterprises' technological and organizational capability and also to create the conditions enabling them to perceive environmental problems in the sector and gradually adapt their management methods to meet environmental criteria. The first step on the modernization path was to increase productivity by establishing extensive plantations, using synthetic fertilizers and herbicides, enhancing species genetically and improving wood quality by the use of techniques such as pruning and thinning. In this way Chilean enterprises quickly mastered the best international forestry practices; thus there only remains a short step to the incremental innovations linking productivity increases to conservation of the environmental functions of the forest ecosystems.

In order to improve wood quality, pioneering enterprises are now designing new low-density plantations in the form of parks that permit considerably greater biodiversity; herbicides and fertilizers can be applied less extravagantly and in a manner appropriate to local conditions; biological pest control methods can be tested; lightweight harvesting machinery that is less detrimental to the soil can be used; smaller areas can be harvested; the soil does not have to be burnt after the trees have been felled to obtain more biomass, as the branches and roots are left to decay; and reforestation can be undertaken without loss of time in order to prevent erosion. Underlying these changes is the fact that environmentally sustainable forestry management methods have a posi-

<sup>15</sup> The interviews in this sector were conducted with the two largest enterprises with plantations of *Pinus radiata* and eucalyptus, forestry enterprises in Region XII (*Nothofagus*), two wood chip producers and owners of small areas of native forest in Region IX. At the meso level, interviews were held in Santiago with the National Forestry Corporation (CONAF), the Forestry Institute (INFOR), the Chilean Wood Corporation (CORMA), CODEFF (a non-governmental organization) and forestry experts from the main universities and consultancy firms. In Regions VIII, IX and XII, the working group visited the regional forestry management offices for small and medium-sized entrepreneurs, as well as the university forestry departments.

<sup>16</sup> In order to halt the country's deforestation, which had been worsening rapidly since the mid-nineteenth century owing to the colonization of the south of Chile, reforestation has qualified for tax allowances or subsidies since 1931. More than one million hectares are currently planted with *Pinus radiata*, a conifer originating in North America. Estimates indicate that this area may increase two- or even threefold in the future.

<sup>17</sup> The natural cost advantages include a favourable climate and a fertile soil, which greatly boost plantation yield compared with the northern hemisphere, as well as the short distances to the export ports.

<sup>18</sup> Between 70 and 80 per cent of plantations are reforested sites on degraded soil; the rest are native forest areas that have been replaced illegally. In contrast to the serious ecological damage caused by eucalyptus plantations in other regions of the world, this species seems to be relatively compatible with the Chilean environment. The plantations contain underbrush, the abundant rainfall is very well suited to the high water consumption of the trees, and Chile offers the eucalyptus a habitat that is similar to Australia, its country of origin.

<sup>19</sup> Hajek, 1991, gives information on damage caused by over-farming and deforestation, particularly since the mid-nineteenth century.

tive impact on costs and help to improve wood quality. The adjustment measures were facilitated because the stability of the markets and the profitability of the plantations generated the necessary financial resources for investing in applied research, improving equipment and trying out new machinery, and because well-trained forestry engineers were available. Willingness to adjust at the micro level was also stimulated by enterprises with an international shareholding that place emphasis on specific aspects of environmental protection and safety at work.<sup>20</sup>

Also, enterprise-to-enterprise cooperation (particularly in applied research) and cooperation between enterprises and university forestry engineering departments are creating conditions for the relatively easy assimilation of the technical and organizational skills which environmental adjustment requires. Within the sector, imitative learning processes are being engaged in by owners of small- and medium-scale forest plantations who can attest to the success of process innovations introduced by large-scale enterprises. This dissemination of information is being encouraged both by the universities that carry out applied research and by enterprise associations.

In the forestry sector, adjustment at the enterprise level is hindered by the lack of a sectoral framework law to regulate the use of natural resources (water, soil and native forests) and by the absence of regional initiatives to prompt all the agencies involved to cooperate in halting the plundering of those resources and in reducing the pollution of other environmental assets (here the monitoring and environmental bodies, community representatives, the representatives of the different sectors, such as forestry, farming and tourism, environmentalists' associations and the representatives of small-scale farmers and of the rural municipalities could play a role). It is true that the Basic Law on the Environment establishes structures that should bring about this regional coordination: the regional environment commissions (COREMA) have advisory boards made up of representatives of the private, trade-union and scientific sectors, as well as the environmentalist groups. How-

<sup>20</sup> This is an area in which the pressure of public opinion in countries with higher environmental and social standards makes itself felt: environmentalist groups now monitor the practices of transnational enterprises, not only in the country of origin, but also at other locations. Enterprises in sectors that have had to halt activities for environmental reasons in the glare of public attention can no longer gain any comparative advantage by moving to countries with lower environmental protection standards.

ever, it is also true that the establishment of these structures entails difficulties in practice since, apart from the problem of regional and local underfunding, the burden of the former system of centralization continues to hinder the mobilization of political and social management and organizational potential in the different regions. Furthermore, the level of organizational capability of the different social sectors is uneven; these advisory boards are thus unlikely in many cases to achieve a balanced consensus of interest.

With regard to the management of native forests, the lack of sectoral regulations and of effective and well-equipped institutional structures (environmental and forestry authorities) is one of the basic causes of the gradual degradation of such forests, since the short-term interests of profit and exploitation predominate with relative ease.<sup>21</sup> The introduction of sustainable management methods has been held back by three factors: (i) the delay in adoption of the initial draft of the Native Forests Act (Jiles, 1992; Villarroel, 1992), which provides for protection and appropriate management of forests of this type; (ii) the little dissemination of information concerning efficient and environmentally appropriate processing and management of native woodlands; and (iii) the low level of development of the markets for native wood products with higher value-added. Consequently, the prevailing situation in regions populated by native forests is one of disordered and destructive firewood extraction and tree-felling to obtain trunks for use in chip manufacture<sup>22</sup> and subsequent replacement of the degraded forests by plantations. This type of lumbering is not sustainable in forestry terms or rational in economic terms since the value-added component remains low, the potential value of the timber is not realized and the regional or local impact as regards creating of new centres of dynamic economic growth or new sources of income is highly uncertain.

<sup>21</sup> It cannot be said that the profit motive predominates totally unchecked since the Forestry Act currently in force requires forest owners to submit their forest management plans to CONAF for approval. CONAF's monitoring capacity is limited; one significant admonishment was its imposition of large fines in 1994 on a number of South-East Asian enterprises for failure to comply with the requirements of the Chilean forestry management plans.

<sup>22</sup> Chips are a necessary input in woodpulp production. Chile exports them predominantly to Japan. Japanese importers request chips from native wood species in order to produce short-fibre pulp (which they also produce from eucalyptus chips), which is the basis for high-quality paper manufacture.

The so far unutilized development potential in most native forest areas strikes one in comparison with the wood sector in the extreme south of Chile, which has developed through careful management of the *Nothofagus* forests.<sup>23</sup> There are four reasons why attempts have been made for some years to manage this tree species in accordance with environmental criteria:

(i) The extreme climatic conditions make it hard to achieve the short maturing cycles that are typical of the pine and eucalyptus plantations in Regions VIII, IX and X. As a result, maintaining plantations with exotic species is no more profitable than developing the slow-growing native *Nothofagus*, and thus there is no incentive to replace this species.

(ii) *Nothofagus* yields a fine wood that is used to manufacture parts and items of furniture for sale in the United States and Europe. The lower-grade wood obtained from thinning to increase the proportion of high-quality wood is converted into chips and exported to Japan, where it is used to produce wood-pulp. In this way, chip manufacture helps to finance sustainable forest management. The attraction of obtaining high-quality wood for furniture production, which is more lucrative, reduces the danger of large-scale felling for chip manufacture.

(iii) The similarity of interests of wood-based enterprises, which are obliged to cooperate in order to satisfy external demand and therefore do not indulge in prejudicial competition, and the fact that the wood-processing industry in this region is very young and fast-expanding have encouraged the development of close cooperation within the sector as well as between enterprises and research centres. As a result of its joint basic and further training programmes, this sector currently possesses a relatively high and uniform level of technological capability and a marked desire to constantly improve it with a view to meeting international quality standards.

<sup>23</sup> To date no scientific analyses or descriptions have been made of the forestry or wood sector in Region XII. The only exception is an environmental impact assessment conducted by the Forestry Institute (INFOR) with a view to a project in Tierra del Fuego. The brief analysis given here is based on discussions held in Region XII in March 1994 with CORMA Austral, Trillium Corp., experts and consultants, representatives of CONAF and CORFO (development of small and medium-sized enterprises) and ProChile (export promotion).

(iv) These efforts are supported at the enterprise level by an efficient institutional framework: there is close cooperation between CORMA Austral and the University of Chile, a centre of excellence for the development of sustainable management methods for native forests, primarily *Nothofagus*. In conjunction with the regional offices of the State export promotion agency (ProChile) and the State production development agency (CORFO), strategies and programmes are being designed to promote the wood-processing industry, including ideas for reducing the environmental impact, marketing the timber and developing the enterprises' physical infrastructure and technological capability.

## 2. Manufacturing sectors

Environmental requirements relating to product properties and the restructuring, enhanced efficiency and rationalization of production processes in the manufacturing sectors are in general more complex than in the natural-resource-based sectors. Compliance with them therefore entails a high level of technological capability, particularly in the export sectors. The technological institutional framework surrounding Chile's industrial sectors is poorly developed; there are no training courses for skilled workers, and the existing applied-research and basic and further training institutions are poorly interrelated. In the sectors examined, these structural weaknesses affect enterprises' innovative capability in a variety of ways according to their level of operational independence (global industries in the woodpulp sector) or dependence (nationally based industries in the case of the wood sector) *vis-à-vis* their surrounding structure.

### a) The woodpulp sector

The export-oriented woodpulp sector is an example of a global industry faced with stringent environmental requirements world-wide. This explains the high adaptability of enterprises in the sector in the areas of technology and organization.<sup>24</sup> As in the

<sup>24</sup> In-depth discussions took place with four enterprises in the sector and two plants were visited. At the meso level, interviews were conducted with CORMA (the sectoral association), ATCP (the engineers' association), a number of independent experts, university research laboratories and institutes, ProChile and Fundación Chile.

case of aquaculture, this sector, whose production is aimed primarily at the world market, is obliged to pursue international levels of efficiency, quality and environmental protection. Environmental protection standards at the enterprise level are therefore very high and in some cases far exceed current regulations in Chile. The ecological requirements for woodpulp relate principally to normal bleaching methods (without chlorine), effluent pollution, water and energy consumption and sustainable management of pine and eucalyptus plantations, from which the wood for pulp manufacture is extracted.<sup>25</sup>

Enterprises' high adjustment capability can be explained by the technology used (equipment, machinery, processes, organization and know-how), which is standardized world-wide. Since they have sufficient available capital, the technology can be acquired independently of the local surroundings. Chilean enterprises belong to international technology networks in which experiences and scientific and technological expertise are exchanged. Also, within these cooperation networks, the organizational methods and concepts needed to apply the know-how and adapt the processes are developed.<sup>26</sup> The informal exchange of experience and practical knowledge concerning new technologies with enterprises and applied-research institutions in other countries is supported in Chile by the research institutes, whose standards are on a par with the best international practices and whose funding is shared by the national woodpulp enterprises. The Woodpulp and Paper As-

sociation (ATCP) also assists in this endeavour by organizing seminars and workshops. Chile's engineering faculties, which produce very well trained graduates, also contribute. At the enterprise level, basic and further training courses make up deficiencies in workers' technical skills.

Because of their sound financial footing and through their membership of international technology networks, woodpulp-producing firms are thus able to make up for the structural inadequacies of the institutional environment and ensure their international competitiveness. However, owing to its low level of interlinkage with national industries and to its export orientation, this sector generates little learning stimulus in the Chilean economy regarding environmental protection at the industrial or enterprise level. Viewed in this way, the enterprises in the woodpulp export sector may be termed "islands of ecological efficiency" that perform no pioneering role in promoting environmental protection in Chile's industrial sector. On the contrary, this very cautious attitude on the part of the enterprises is consistent with the defensive strategy of CORMA, the sectoral association, which rejects controls with the basic argument that State intervention in the private domain is illegal. Taken to its extremes, this sector could be regarded as an example of halfway environmental modernization because, although it is capable of making technological progress in the interests of competitiveness, it restricts its motivations to the logic of the market, so that its positive environmental impact is predominantly collateral and haphazard.

#### b) *The wood sector*

The present situation in the woodpulp sector differs from that in the wood sector, whose current adaptability is limited.<sup>27</sup> This is because of the complexity of the requirements and the not infrequently high level of technological difficulty involved in the necessary adjustment measures. The sector also has a large proportion of small and medium-sized enterprises that are short of both funds and staff. It is here

<sup>25</sup> In response to environmental groups' information campaigns and existing awareness about paper recycling (Greenpeace International, 1991 and 1993), the European pulp and paper industry has made considerable efforts to improve its environmental profile. Consequently, in recent years there has been an enormous increase in the demand for non-chlorine bleached pulp, basic to the European market, which subjects supplies to detailed testing for low production pollution levels. This trend is becoming widespread and strengthened as a result of the various ecological seals of approval granted for paper products by Scandinavia and the European Union (see the requirements relating to ecological seals of approval for toilet paper and kitchen towels in European Commission, 1994a and 1994b). The German ecological seal of approval is awarded only to products made entirely from recycled paper.

<sup>26</sup> The woodpulp sector became attractive to foreign investment in the course of privatization of public enterprises and the opening up of the global market. The three new plants that began operating in 1991 and 1992 were funded by multinational investors. For information on the development of the sector in Chile, see Stumpo (1994) and DICEIPA (1992).

<sup>27</sup> Interviews were conducted with 12 enterprises of different sizes that produce doors, furniture components and items of furniture, as well as one paint manufacturer, one certification enterprise and 12 meso level institutions concerned with the development of small and medium-sized enterprises, technology transfer, and basic and further training.

that the deficiencies in the industrial technology support framework make themselves felt, namely the lack of skilled and well-trained workers and the shortage of structures for the transfer and adaptation of new manufacturing methods. The situation is also affected by general structural deficiencies, such as the absence of a public infrastructure for the disposal of effluents and solid waste or the impossibility of obtaining loans to finance investment.

The different environmental requirements currently focus on toxic substances (ban on PCFCs, limits on formaldehyde emissions, harmfulness of paints and varnishes) and packaging materials; the sustainability of forest management methods is an important factor for European import markets where native wood products are concerned. If the standards of environmental protection in the European furniture industry continue to rise, the environmental impact of finishing techniques (e.g. painting) used by third country producers that export to Europe may cut off access to the markets in that continent.<sup>28</sup>

The adaptability of enterprises in the wood-processing sector varies greatly because of the heterogeneous nature of the sector.<sup>29</sup> Since the enterprises' level of competitiveness is still relatively

low, the proportion of high-quality exports to markets where ecological requirements are imposed continues to be small. Consequently, there is no incentive to meet foreign environmental demands or undertake adjustment measures, since such requirements do not exist in the market segments that these enterprises supply, for example the United States. In the medium and long terms, however, the sector's development will depend on the enterprises' incorporation of environmental protection features into their modernization strategies at the technological and organizational levels.

The weak cooperation and coordination links between enterprises also hinder the sector's endeavours to enhance its technological capability and its ability to respond to complex environmental requirements. A particular problem in this area is the supply of environmentally sound inputs, such as sawn wood that has not been chemically treated and paints and varnishes that are ecologically safe.

Other important areas in which environmental protection has yet to have an impact are quality control and certification (including inputs and intermediate products), standardization, technology consultancy, training of forestry experts and technicians and applied research into wood processing. At the meso level, a number of institutions are now working in these areas, such as INFOR in wood quality certification, the Wood Industrialists' Association (ASIMAD) in end-product certification and quality control, and SERCOTEC and CORFO in technological advice to small and medium-sized enterprises. However, it is primarily these institutions that would need to improve their mutual cooperation in order to promote the necessary coordination and to pool efforts. This is particularly important if the applied research efforts of the universities is to be of benefit to small and medium-sized enterprises, whose limited resources do not permit them to bear the cost of research or acquire available technical solutions.

The fact that environmental issues are undervalued in the work schedules of applied-research, technology consultancy and vocational training institutions is because enterprises and the official environmental protection agencies generate little demand for solutions of this kind. It would thus be advisable to organize awareness and in-service training programmes for staff members of those organizations so that they are able to deal with the new requirements that enterprises will have to face.

<sup>28</sup> Concerning the indicators for measuring and evaluating the environmental impact of the furniture industry, see Lehmann, 1993.

<sup>29</sup> As regards the sawmills and the manufacturing industry, which generate more than 26 per cent of wood product exports, small, medium-sized and large enterprises accounted for one third of total production in each case. There are enormous differences between them in terms of productivity and efficiency. The veneer and board industry is made up of 14 medium-sized enterprises; production of doors and mouldings is in the hands of eight small, ten medium-sized and two large enterprises; the two subsectors between them account for about 4 per cent of total exports. No definite information is available on the number of plants operating in the furniture industry; in the three size categories there is a vast number of factories producing exclusively for the domestic market or for export or endeavouring to place part of their production abroad. The industrial development of this sector has so far been characterized by the gradual combination of the forestry enterprises and sawmills. None the less, these amalgamated enterprises discontinued the production of furniture for export after a few attempts that generated heavy losses. In the area of furniture production for export, the most prosperous enterprises are a few medium-sized businesses employing between 80 and 140 workers, most of them originally designed as furniture factories, that have found market niches by dint of intensive searching. About 50 per cent of their production finds outlets in the European markets (Scholz, Block, Feil, Krause, Nakonz and Oberle, 1994, pp. 58 *et seq.*).

# V

## Conclusions and challenges

In order to correlate the factors that inhibit or favour environmental adjustment measures in the export sectors, the findings of the survey on which this article is based have been classified by social agent groups and by action plan within the framework of the concept of systemic competitiveness. In this way, an attempt will also be made to explain some aspects of the interaction generated by global trade as a driving force between the environmental reform processes in the industrialized countries and the adjustment processes in the developing countries.

### 1. Micro level

The research took as its starting point the environmental adjustment processes at the enterprise level. From the examination made of successful cases (aquaculture, the forestry sector, woodpulp and furniture manufacture in Region XII), a number of points can be put forward regarding enterprises' needs in order to facilitate their adjustment to product and process requirements. They are as follows:

(i) An organizational structure conducive to innovation; if possible the existence of an environment department that collaborates closely with the applied-research, personnel and sales areas in developing proposals for improving production processes and products (in their range of benefits and properties), taking account of employees' innovation suggestions;

(ii) An enterprise management that is aware of the need for continuous innovation in production processes and increased efficiency;

(iii) The existence of well-trained specialists (engineers) who have the necessary expertise to implement environmental innovations;

(iv) Ongoing basic and further training for staff, particularly skilled workers and technicians;

(v) The establishment of enterprise networks at the sectoral level (or national or international level, as appropriate) for joint activities in the areas of applied research, training, sales and marketing;

(vi) The creation of a capacity to assimilate external quality and efficiency standards and encourage

appropriate adjustment action within the framework of enterprises' general export orientation.

### 2. Meso level

An efficient enterprise support structure is a basic requirement for assisting and facilitating adjustment measures adopted at the enterprise level as environmental aspects are incorporated into the business management (technological guidance institutions and the educational sector). The intermediary organizations (enterprise associations and sectoral development and consultancy institutions) can at the same time play an important linkage role between the macro and micro levels with a view to establishing agreed environmental objectives, creating the means to pursue them and increasing the prospects of achieving them. The cases examined indicate that, in order to bring about appropriate adjustment at the enterprise level, the institutional framework must meet the following needs:

(i) Technological institutions to conduct research for practical application purposes and offer appropriate services to innovation-minded enterprises so that they can broaden their areas of activity with an environmental component and assimilate specific know-how. In the forestry sector, this relates to sustainable management of pine and eucalyptus plantations, biological pest control, genetic enhancement of species and the management of native forests; in the wood-processing industry, the development of non-polluting methods of conserving and treating wood, including native timber; and in the woodpulp sector, chlorine-free bleaching methods, testing and certification of pulp quality, as well as measuring, testing and certification of the industrial impact on the environment;

(ii) Seminars, workshops and working groups in the sectoral associations to promote imitative learning and enable enterprises to operate uniformly with regard to quality and environmental protection (aquaculture, the forestry sector and furniture manufacture in Region XII);

(iii) Study programmes of vocational education institutions and training courses that take account of the new enterprise requirements;

(iv) Possibility of close interlinkage of the activities of the sectoral associations and applied-research and basic and further training institutions.<sup>30</sup>

If the enterprise support structure is able to undertake these functions, there will be considerable prospects for responding appropriately to external requirements, even if such requirements are complex and technology-intensive, and for ensuring that enterprises are not over-stretched and edged out of the market.

Large enterprises that are members of international cooperation networks can overcome the inadequacies of a weakly structured and poorly linked institutional framework and remain strongly competitive (woodpulp sector). However, small and medium sized enterprises depend, for their environmental adjustment, on the services provided by their surrounding structure (forestry management, furniture industry); what they need is not only technological assistance but also physical infrastructure (for example, joint systems for the treatment and disposal of industrial effluents and waste).

### 3. Macro level

There are two essential factors in promoting the adoption of environmental adjustment measures by enterprises:

(i) If the activity is dependent on the existence of natural resources, that can prevent the over-exploitation of these resources if there is no satisfactory way to replace them (furniture industry based on *Nothofagus* timber);

(ii) The focus of the economic model on competitiveness and the global market obliges enterprises to adopt ongoing measures in order to boost competitiveness and efficiency or to comply with international quality and efficiency standards; since the best technological practices are generally more efficient than the older technologies in terms of energy and raw material consumption, the assimilation of the former will at least have a positive collateral impact on the environment (woodpulp sector, forestry sector).

<sup>30</sup> The last two requirements have still not become a reality in Chile, but those interviewed described them as deficiencies. Presentation of the findings revealed lively interest in this topic among the representatives of the basic and further training institutes. During the discussions, all the meso-level institutions (applied research, technology transfer, development of small and medium-sized enterprises and sectoral bodies) stressed the need for improved coordination and linkage of their activities.

If there is no independent environmental policy to determine adjustment and protection objectives at the sectoral level, enterprises will persist in maintaining a defensive and reactionary strategy instead of mobilizing and optimizing their potential to solve the problems affecting them. As far as the new natural-resource-dependent export sectors are concerned, this suggests that environment controls promoting more efficient management of such resources can accelerate the switch from extensive to intensive raw material use, with the consequent development of manufacturing sectors with a higher value-added component (the Forestry Act explicitly pursues this dual objective).<sup>31</sup> An active environmental policy can thus help to create new competitive advantages.

### 4. International level

The statutory or market ecological requirements which relate to products or processes or to the pre-production and post-production stages and which are transmitted through trade with countries whose environmental standards are more rigorous can give rise to and promote technological and organizational learning and innovation processes for the benefit of the environment. An important requirement in strengthening this interaction is an open market: exporting enterprises will respect environmental regulations if these are implemented in the import markets. However, enterprises' readiness to invest in modernization for ecological purposes diminishes when there are reasons to doubt the seriousness of environmental requirements (disguised protectionism) or if potential import markets are virtually inaccessible to products which are more sophisticated from the viewpoint of environmental protection. If protectionist regulations increase, they may cancel out the positive effects of ecological demands imposed on third-country producers and cause them to divert their trade to countries that do not lay down so many product requirements.

<sup>31</sup> Intensive use, in contrast to extensive use, is based on the principles of efficiency (non-squandering of natural resources) and sustainability (exploitation of natural resources with an eye to their natural regeneration cycle and conservation of the functions of the ecosystem to which each natural resource belongs).



The counterproductive effects of protectionist practices on the attitudes of third-country enterprises are not the only argument against commercial measures of an environmental nature that a number of enterprise associations and industrial sectors in the industrialized countries are calling for in the debate in favour of the "greening of GATT". An environment-focused trading policy must also take account of the specific initial conditions –economic, technological, organizational and environmental– in which businesses operate. For instance, if some weak operators are obliged to cope with requirements which in the short term exceed their innovation and adjustment capability, the result may be that exports are diverted to markets that are less stringent in

their ecological requirements. Environmental policy development may be held back if ecological requirements are identified with protectionist interests, thus obscuring the real underlying problems.

The confirmation that international trade can promote environmental learning processes in developing export countries like Chile highlights another important aspect: the progress achieved in environmental reform in the industrialized countries may also encourage the developing countries to develop the necessary political and economic scope for the establishment of more environmentally sound production patterns.

(Original: German)

### Bibliography

- Bennett, G. and B. Verhoeve (1994): *Environmental Product Standards in Western Europe, the US and Japan. A Guidebook*. Arnhem, Netherlands, Instituut voor Europees Milieubeleid.
- Bundesstelle für Aussenhandelsinformationen (bfai) (1995): Länderreport Chile. Wirtschaftstrends zum Jahreswechsel 1994/95, (Country report: Chile). Cologne, Germany, bfai, 1995.
- Chile (1994): Ley sobre bases generales del medio ambiente, *Diario Oficial de la República de Chile*, No. 34.835, Santiago, Chile, 9 April.
- CIPMA (Environmental Research and Planning Center) (1992): *Gestión ambiental en Chile. Aportes del 4º Encuentro Científico sobre el Medio Ambiente*, Santiago, Chile.
- DICELPA (Federación Técnica Iberoamericana de la Celulosa y el Papel) (1992): *Directorio de la industria de la celulosa forestal y del papel: productores y proveedores 1992-1993*, Santiago, Chile, Organización PuntoDiez.
- Dockendorff, E. and others (1990): *Chile en sus regiones. Materiales para el análisis y la acción*, Santiago, Chile, Centre for Socio-economic Research for Development (CED).
- Esser, K., W. Hillebrand, D. Messner and J. Meyer-Stamer (1994): *Competitividad sistémica. Competitividad internacional de las empresas y políticas requeridas*, Berlin, German Development Institute (GDI).
- European Commission (1993): Council Regulation 1836/93 allowing voluntary participation by companies in the industrial sector in a Community eco-management and audit scheme, *Bulletin of the European Communities* L 168, Brussels, European Communities, June.
- (1994a): Commission Decision of 14 November 1994 establishing the ecological criteria for the award of the Community eco-label to toilet paper (94/924/CE), *Bulletin of the European Union*, No. 364/24, Brussels, European Communities, December.
- (1994b): Commission Decision of 14 November 1994 establishing the ecological criteria for the award of the Community eco-label to kitchen rolls (94/925/CE), *Bulletin of the European Union*, No. 364/32, Brussels, European Communities, December.
- Gómez-Lobo, A. and J. Jiles (1993): La experiencia chilena en regulación pesquera, O. Muñoz (ed.), *Después de las privatizaciones: hacia el estado regulador*, Santiago, Chile, Economic Research Corporation for Latin America (CIEPLAN).
- Greenpeace International (ed.) (1991): *Weniger Müll, mehr Wald. Konzepte zum Einsparen und Recyceln von Papier*, Hamburg.
- (1993): *Papier – Naturprodukt oder Chemiecocktail*, Hamburg.
- Hajek, E. R. (1991): *Chile, la situación ambiental en América Latina. Algunos estudios de casos*, Buenos Aires, Centro Interdisciplinario de Estudios sobre el Desarrollo Latinoamericano (CIEDLA).
- Hillebrand, W., D. Messner and J. Meyer-Stamer (1994): *Strengthening Technological Capability in Developing Countries. Lessons from German Technical Cooperation*, Berlin, GDI, December.
- Hunt, D. and C. Johnson (1993): The systems approach to corporate environmental management and environmental auditing, *Business Strategy & Environment*, vol. 2, No. 1, Shipley, United Kingdom, ERP Environment.

- Hurtienne, T. and D. Messner (1994): Nuevos conceptos de la competitividad, *Cambio de rumbo en el Cono Sur. Los casos de Argentina, Chile y Uruguay*, Caracas, Editorial Nueva Sociedad.
- Jha, V., R. Vossenaar and S. Zarrilli (1993): *Ecolabelling and International Trade*, Geneva, United Nations Conference on Trade and Development (UNCTAD).
- Jiles, J. (1992): Análisis económico: valoración social vs. valoración privada, dilema clave para una regulación efectiva del bosque nativo, *Ambiente y Desarrollo*, Santiago, Chile, Environmental Research and Planning Center (CIPMA).
- Karl, H. (1993): Europäische Initiative für die Einführung von Umweltschutz-Audits: Kritische Würdigung aus ökonomischer Sicht, *List-Forum*, vol. 19, No. 3, Baden-Baden, Germany, Nomos.
- Lehmann, S. (ed.) (1993): *Umwelt-Controlling in der Möbelindustrie: Ein Leitfaden*, Berlin, Institut für ökologische Wirtschaftsforschung.
- Madrid, R. and C. Ominami (1989): *Lineamientos estratégicos para una inserción activa en los mercados internacionales*, Santiago, Chile, Latin American Institute of Transnational Studies (ILET).
- Maggi, C. (1994): *Descentralización territorial y competitividad: El caso de Chile*, Berlin, GDI.
- Mármora, L. and D. Messner (1992): Chile im lateinamerikanischen Kontext – Ein Modell für Demokratisierung und Entwicklung in der gesamten Region?, J. Ensignia and D. Nolte (eds.), *Modellfall Chile? Ein Jahr nach dem demokratischen Neuanfang*, vol. 34, Hamburg, Instituto de Estudios Iberoamericanos.
- Messner, D. (1993): Shaping competitiveness in the Chilean wood-processing industry, *CEPAL Review*, No. 49, LC/G. 1757-P, Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).
- North, K. (1992): *Environmental Business Management: An Introduction*, Geneva, International Labour Organisation (ILO).
- OECD (Organization for Economic Cooperation and Development) (1991): *Environmental Labelling in OECD Countries*, Paris.
- Sanhueza, G. (1992): Der Umweltschutz: eine weitere Herausforderung an die Demokratie, in J. Ensignia and D. Nolte (eds.), *Modellfall Chile? Ein Jahr nach dem demokratischen Neuanfang*, vol. 34, Hamburg, Instituto de Estudios Iberoamericanos.
- Schmidheiny, S. and Business Council for Sustainable Development (1992): *Changing Course: A Global Business Perspective on Development and the Environment*, Cambridge, MA, Massachusetts Institute of Technology.
- Scholz, I. (1993): *Requerimientos ambientales a productos de consumo en Alemania y sus efectos sobre las exportaciones de los países en desarrollo*, Berlin, GDI.
- Scholz, I., K. Block, K. Feil, M. Krause, K. Nakonz and C. Oberle (1994): *Medio ambiente y competitividad: El caso del sector exportador chileno*, Berlin, GDI.
- Stumpo, G. (1994): *Desempeño, competitividad y perspectivas del sector de papel y celulosa en Chile*, Santiago, Chile, ECLAC.
- UBA (Federal Environment Office) (1992): *Ökobilanzen für Produkte*, Berlin.
- Villarroel, P. (1992): ¿La ley que todos esperaban?, *Ambiente y desarrollo*, vol. 8, No. 3, Santiago, Chile, Environmental Research and Planning Center (CIPMA).
- Vincent, J. R. and C. S. Binkley (1992): Forest-based industrialization: A dynamic perspective, in N. P. Sharma (ed.), *Managing the World's Forests. Looking for a Balance Between Conservation and Development*, Washington, D. C., World Bank.
- Wiemann, J. and others (1994): *Ecological Product Standards and Requirements as a New Challenge for Developing Countries' Industries and Exports. The Case of India's Leather, Textile and Refrigeration Industries*, Berlin, GDI.
- Welford, R. (1993): Breaking the link between quality and the environment: Auditing for sustainability and life cycle assessment, *Business Strategy & Environment*, vol. 2, No. 4, Shipley, United Kingdom, ERP Environment.