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TEXTO PARA DISCUSSÃO

N° 93

Relationships between trade and the environment: the Brazilian case

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Julho de 1994

FUNCEX fundação centro de estudos do comércio exterior

Relationships between trade and the environment: the brazilian case*

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June, 1995

** This study was sponsored by UNCTAD and UNDP – United Nations Development Program, and is part of a broader project which embodies a series of national case studies on trade and the environment.*

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Introduction

During the 1970s, the Brazilian economy grew at average annual rates of approximately 10%. From the second half of the decade on, confronted with the negative effects of the rise of oil prices on its foreign accounts, Brazil had resource to foreign debt in order to expand its import substitution strategy – viewed as a way of reducing the vulnerability of its economy on external factors.

- This strategy was implemented under an authoritarian political system in accordance with an economic model that was open to foreign investments, but strongly import-restrictive. It embodied four components, all with 5 activities in the South/Southeast and the expansion of export-oriented cultures and/or cultures that would reduce its dependence on oil imports: soybeans and oranges are examples of export cultures, while sugar-cane for alcohol-production illustrates the latter case;

- The establishment of export-oriented development hubs for livestock, forestry and mining activities in the Amazon Region;

- The development of an energy generation and transmission infrastructure expansion program, through investments in oil drilling and exploration, as well as the construction of huge hydroelectric plants in several parts of the country; and

- The implementation of sectorial industrial investment programs for intermediate goods, such as cement, pulp and paper, fertilizers, chemicals, steel and aluminum.

Brazil's answer to the international crises caused by successive oil price hikes was to seek ways to lighten foreign pressures, largely by expanding industrialization. This meant primarily that the capital content of industrial, agricultural and infrastructure activities increased expressively, boosting the average sizes of both production plants and production scales. It also indicated that the country's basic inventory of natural and energy resources was its main domestic asset mobilized to make this new strategy feasible, subject to intense pressures forcing increased exploitation and use.

The environmental costs of this strategy started to appear in the 1980s, when the first domestic regulatory measures were developed through the establishment of Brazil's National Environment Policy, basically sustained by instruments of command and control such as standards, zoning, sanctions, licenses, etc.

Until recently, the problems of deforestation caused by the implantation of cattle- breeding, forest exploitation projects and mineral production hubs, as well as huge hydroelectric projects in the Amazon region, attracted the attention and concern of local and international environmental agencies. For Brazil, the environmental impacts of export-oriented activities seemed to involve only the primary sector of the economy.

Nevertheless, economic and regulatory changes in Brazil and worldwide have been diversifying the focus of concern over the trade-off between economic growth versus environmental preservation. In this scenario, a new field of preoccupation, studies and negotiations is created around the pattern of economic use of environmental resources by Brazilian industry and the consequences of this pattern on its present and future

competitiveness. Recent studies spotlight the high participation of industrial sources in the emission of organic matter and heavy metals in Brazil (60% and almost 100% respectively).[1]

The sectorial investment programs in intermediate industries set up in the 1970s were largely aimed at increasing the country's installed capacity, in order to reduce import expenditures. Hence, exporting was not the original objective of these programs. The foreign debt crisis of the early 1980s, together with the economic policies that curbed domestic demand and encouraged the expansion of exports, went into effect in response to this new foreign constraint. This triggered a rapid growth spurt in exports of intermediate goods making intensive use of energy and natural resources, while producing appreciable amounts of industrial pollution.

The macro-economic and development model crisis undergone by Brazil since the early 1980s only reinforced the level of specialization in Brazilian industry, based increasingly on sectors making intensive use of environmental resources and, within these sectors, on the initial segments of the production chain. In fact, the reduction in private investments has only saved those production segments with clear-cut comparative advantages and firmly-established market positions abroad. Shrinking domestic demand affected investments in segments making less intensive use of environmental resources – such as electrical and mechanical materials etc. – in which Brazil presented a high growth in production, exports and international specialization indicators in the 1970s.

The past decade and the early 1990s therefore witnessed a reinforcement of the model of industrialization and international insertion produced by both the over-investment of the 1970s and the crises of the 1980s. A prime example of this trend is the concentration of the dynamic axes of industrial structural changes and export growth in sectors intensive in environmental resources and production scale.[2] As will be demonstrated later on, the comparative advantages of Brazilian exports are directly related to the level of intensity of use of natural resources, in general increasing in proportion to the intensity of this use.

Increasingly concentrated in products making intensive use of environmental resources and in markets to which access depends more and more on compliance with technical and environmental regulations,[3] Brazil's industrial exports grew particularly sensitive to the issue of the relationships among international competitiveness, trade rules and environmental regulations. This is confirmed by the fact that if the "dirty" industries are the dynamic sectors of Brazilian exports, they are also those that use energy and natural resources[4] more intensively.

A detailed analysis of Brazil's exports list in the first section of this work indicates the degree of its vulnerability to the imposition of international environmental and technical rules and standards. This

1 Seroa da Motta, R. – Política de controle ambiental e competitividade – paper prepared for the Study of the Competitiveness of Brazilian Industry, Campinas, 1993.

2 Motta Veiga, P. – Exportações brasileiras: desempenho, especialização internacional e mudança estrutural – Discussion Text nº 56, Funcex, Rio, 1991.

3 In 1970, 48% of Brazilian exports were directed to the principal OECD markets. By 1990, this percentage had increased to 62.4%.

4 With regard to these resources, it is nevertheless worth noting that their utilization does not necessarily lead to exhaustion of the resource base; Brazil has its own specific characteristics in terms of physical assimilative capacity.

analysis takes into consideration selected indicators of the intensity of use of natural resources, energy and pollution. It also makes it possible to identify more sensitive sectors in terms of environmental restrictions. The second section of the work offers an in-depth examination of the selected sectors – **Pulp and Paper, Steel, and Pig-Iron**[5] – in order to pinpoint effective and potential environmentally-based trade restrictions, as well as the business strategies of these same sectors. Some of this information was supplied by business associations and companies. Finally, the third section presents the concluding remarks, and suggests some government lines of action to improve Brazil's competitive edge, while bearing environmental issues in mind.

I. Development and composition of brazilian exports

Brazilian exports have undergone appreciable changes over the past 20 years, in terms of both value and composition. By the late 1960s, Brazil's list of exports was strongly concentrated on primary products, with the total value exported falling below US$ 3 billion (see Table I.1).

From the late 1960s onwards, measures were implemented designed to alter the pattern of Brazil's insertion into the international scene, based on diversifying the list of its exports while boosting values, leaning towards products with a higher added value, as well as broadening its markets. During a period of rapid growth in the Brazilian economy – particularly the consumer durable goods production industry – between 1968 and 1973, the country’s GNP grew by 11% per year, while its processing industry expanded by 14% per year. Spurred by a drive to expand the nation’s agricultural frontiers, exports followed this across-the-board trend in the economy. The tools used to foster export activities were basically incentives and subsidies, in addition to replacement of the foreign exchange regime with a multi-level devaluation system.

The sectorial programs contained in Brazil's II National Development Program (1974) thus shaped the current configuration of the nation’s exports. Forging ahead with the Import Substitution Process – as a way of reducing the *vulnerability of the Brazilian economy to external factors* – a financing and incentives system was set up which, together with a hike in import tariffs, underwrote the installation of intermediate and capital goods industries in Brazil. The State played an important role in this process, not only as the *coordinator and provider* of funding, but also as a production agent in various areas of activities.

The main sectors covered by this Program were: machinery and equipment, chemicals and petrochemicals, steel, pulp and paper, and the energy sector. Projects included reasonably optimistic built-in projections for growth and domestic demand and, as a secondary objective, the generation of exportable surpluses (From Table I.3. onwards, note the importance acquired by these groups of

5 Some comments are made about the Iron Ore sector.

products in Brazilian exports). In the case of the energy sector, the objective was to achieve nationwide autonomy in terms of energy supplies,[6] in response to soaring oil prices throughout the decade.

I.1. Development of brazilian exports

The expansion of Brazilian exports between 1970 and 1993, as may be seen in Table I.1., topped 1,300%, to reach US$ 38.8 billion by 1993. Characterized by the rising participation of more elaborate products, this growth nevertheless did not manage to boost Brazil's share of total global trade.[7]

These growth rates are also clearly differentiated when studied in sub-periods. After a period of intensive growth throughout the 1970s and early 1980s – up to 1984 – even higher than the growth rates for world exports and those of other newly industrialized countries, the development of foreign sales fluctuated appreciably between 1985 and 1991. During this period, foreign development was strongly influenced by the domestic macro-economic situation, characterized by rising rates of inflation – and attempts to stabilize the economy – as well as by a deterioration in the investment capacity of the State and stagnation in levels of domestic activity. In addition to this macro-economic instability undermining business strategies, eating away at the financing capacity of private agents and adversely affecting the development of the real foreign exchange rate, the incentives, subsidies and even financing of exports granted at the start of the decade in order to encourage exports were gradually phased out.

During this decade, after exports had been strongly affected by the overvaluation of the local currency in 1991, they once again returned to growth, to chalk up a record figure in 1993 of US$38.8 billion.

With regard to the composition of exports, during the 20 years mirrored in Table I.1., basic products dropped from 85% of foreign sales to 24% in 1993, which was offset by the increasing participation of manufactured products – in the last year available, they accounted for some 60% of exports – as well as semi-manufactured products, whose participation rose to 14.1%.

[6] This was a period of major investments in building hydro-electric plants – such as Itaipu, whose hydro-electric power generation capacity today reaches 12,600 MW (23% of Brazil's current installed generation capacity) – as well as oil prospecting and drilling, whose output increased 278% between 1974 and 1992.

[7] Although Brazil accounted for 1.4% of worldwide exports in 1984, this figure shrank during the 1980s, showing an inability to maintain the high expansion rates of foreign sales chalked up over the previous period. In fact, as shown below, the export performance of the Brazilian economy during the second half of the 1980s was undermined by the nation's macro-economic domestic crisis.

Table I.1

Development of Brazilian Exports (US$ million)

Period	Overall Total	Basics	%	Industrialized						Special Operations
				Total	%	Semi-manufact.	%	Manufac-tured	%	
1964	1,430	1,221	85.4	204	14.3	115	8.0	89	6.3	5
1965	1,595	1,301	81.5	284	17.8	154	9.6	130	8.1	11
1966	1,741	1,444	82.9	293	16.8	141	8.1	152	8.7	4
1967	1,654	1,306	79.0	339	20.5	147	8.9	192	11.6	9
1968	1,881	1,496	79.5	376	20.0	178	9.5	198	10.5	9
1969	2,311	1,803	78.0	488	21.1	211	9.1	277	12.0	20
1970	2,739	2,057	75.1	657	24.0	249	9.1	408	14.9	25
1971	2,904	1,991	68.6	820	28.2	247	8.5	573	19.7	94
1972	3,991	2,649	66.4	1,298	32.5	399	10.0	898	22.5	45
1973	6,199	4,030	65.0	2,008	32.4	574	9.3	1,434	23.1	161
1974	7,951	4,577	57.6	3,180	40.0	917	11.5	2,263	28.5	195
1975	8,670	5,027	58.0	3,434	39.6	849	9.8	2,585	29.8	209
1976	10,128	6,129	60.5	3,618	35.7	842	8.3	2,776	27.4	381
1977	12,120	6,959	57.4	4,884	40.3	1,044	8.6	3,840	31.7	278
1978	12,659	5,978	47.2	6,504	51.4	1,421	11.2	5,083	40.2	177
1979	15,244	6,553	43.0	8,532	56.0	1,887	12.4	6,645	43.6	159
1980	20,132	8,488	42.2	11,376	56.5	2,349	11.7	9,028	44.8	268
1981	23,293	8,920	38.3	14,000	60.1	2,116	9.1	11,884	51.0	374
1982	20,175	8,238	40.8	11,686	57.9	1,433	7.1	10,253	50.8	251
1983	21,899	8,484	38.7	13,109	59.9	1,833	8.4	11,276	51.5	307
1984	27,005	8,706	32.2	18,004	66.7	2,872	10.6	15,132	56.0	295
1985	25,639	8,538	33.3	16,821	65.6	2,758	10.8	14,063	54.8	280
1986	22,349	7,280	32.6	14,895	66.6	2,492	11.1	12,404	55.5	173
1987	26,224	8,022	30.6	18,014	68.7	3,175	12.1	14,839	56.6	188
1988	33,789	9,411	27.9	24,079	71.3	4,892	14.5	19,188	56.8	299
1989	34,383	9,548	27.8	24,440	71.1	5,805	16.9	18,634	54.2	395
1990	31,414	8,747	27.8	22,118	70.4	5,108	16.3	17,011	54.2	549
1991	31,620	8,737	27.6	22,448	71.0	4,691	14.8	17,757	56.2	436
1992	36,148	8,878	24.6	26,801	74.1	5,205	14.4	21,596	59.7	469
1993	38,814	9,408	24.2	29,097	75.0	5,459	14.1	23,638	60.9	309

Source: MICT/SECEX. Prepared by: FUNCEX.

The development of Brazil's list of exports may be better understood by the quantum and price indicators (see Table I.2.). Throughout the 1980s and early 1990s, an across-the-board trend was noted towards an increase in quantity.[8] The development of price indices is less regular, although in 1993 and in most of the preceding years, this features an index lower than in 1980.

[8]Exceptionally, an upsurge took place in 1986, when the rapid heating-up of the domestic market had a marked effect on the Trade Balance, reducing exports and expanding imports.

Among the groups, the prices of semi-manufactured products dropped most sharply, offset by huge increases in quantity. This group of products is consisted of commodities that are not highly processed – such as iron and steel semi-manufactured products, raw soybeans oil and woodpulp – that face heavy competition on the foreign market and are strongly influenced by the growth rates of the world economy.

Manufactured products also have to cope with dropping prices, although not as steeply as those semi-manufactured products. In the case of these products, it may be said that this behavior is linked to the fact that Brazil is operating more intensively in sectors with a lower technological content, and where the international markets are less dynamic. It should be emphasized that, among the manufactured products, exports are concentrated in products of lower added value.

Table I.2

Export Indices[1]

Year	Total		Basics		Semi-manufactured		Manufactured	
	Price	Quantum	Price	Quantum	Price	Quantum	Price	Quantum
1979	94.61	80.06	97.65	78.31	96.06	87.95	91.41	80.45
1980	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1981	93.10	125.00	89.70	115.70	89.80	99.60	95.42	141.44
1982	88.45	116.62	83.24	114.31	75.61	82.07	95.32	127.58
1983	83.14	137.15	82.49	119.69	69.41	113.34	85.79	159.35
1984	85.47	167.19	83.56	121.72	83.74	153.01	86.91	217.83
1985	79.91	173.20	72.54	139.25	73.83	169.84	85.60	209.11
1986	92.47	143.05	111.50	90.23	69.01	157.85	83.77	190.96
1987	94.28	171.62	98.84	124.10	75.95	183.06	90.48	211.68
1988	104.46	202.51	109.81	135.14	90.76	247.68	98.35	251.26
1989	108.95	201.70	106.74	144.47	93.21	284.09	105.24	232.42
1990	109.28	185.36	102.04	136.96	80.63	289.49	111.76	202.67
1991	104.36	200.56	105.51	132.57	75.06	418.31	103.71	227.80
1992	91.11	267.95	98.12	144.24	68.01	504.48	86.39	341.70
1993	89.47	301.98	97.04	155.78	65.42	582.67	85.62	390.56

Source: MICT/SECEX. Prepared by: FUNCEX. (1) Laspeyres Index.

I.2. Standard of specialization

The Table that follows shows the development of major groups of products since 1975. As may be seen, during these 20 years, the list of exports has diversified to expand the participation of manufactured and semi-manufactured products. This aspect is made manifest through the growth in exports of products until then relatively inexpressive on this list – such as pulp and paper and transportation material – as well as through a reduction in the share of more traditional products such as coffee (in the case of primary products) and textiles (manufactured products). This was one outcome of the import substitution strategy of the 1970s. Additionally, the sample selected represented some 94% of the total in 1975, while it currently accounts for only 84%.

Table I.3

Structure of Brazilian Exports (%)

	1975	1980	1985	1990	1993
Food & Beverages	52.80	45.60	35.49	25.88	23.38
Metallurgy & Iron/Steel	17.22	12.77	14.66	19.58	17.49
Machinery & Equipment	6.60	9.17	8.47	11.17	11.90
Transportation Materials	3.72	7.52	6.61	7.32	8.70
Chemicals & Petrochemicals	2.30	3.06	5.92	6.47	6.66
Leather & Footwear	3.10	2.91	4.80	4.80	6.22
Pulp and Paper	0.67	2.57	2.17	3.84	3.89
Textiles	6.18	4.55	3.90	3.97	3.56
Leaf Tobacco	1.72	1.47	1.79	1.99	2.32
Sub-total	94.31	89.61	83.81	85.02	84.13
Total (in US$ million)	**8,658**	**20,132**	**25,639**	**31,414**	**38,783**

Source: MICT/SECEX. Prepared by: FUNCEX.

In general terms, this specialization in exports may be described in a more detailed manner based on an examination of the performance of major groups of products.

- Food and Beverages shrank in importance on the export list throughout this period, accounting for 23% compared to 52% in 1975. Two aspects are relevant: i) there is no reduction in *volumes* exported but rather an ongoing downtrend in the international prices of these products – principally commodities – of primary origin; ii) although the participation of these products is clearly shrinking, the value exported has developed positively.

- Iron, steel and metallurgical products accounted for 17.5% of Brazilian exports. Their participation has featured some fluctuations during the period, although leaning towards a steady increase in more highly processed products – manufactured and semi-manufactured goods. In 1993 they accounted for 41% and 16.5% of exports in this group respectively. Over the period, the share of primary products declined.[9]

- Machinery and Equipment, together with Transportation Materials, accounted for some 20.6% of Brazilian exports. The principal products exported by these groups are: engines, vehicles and auto-parts. In the early 1980s, these groups achieved a fairly significant quantitative leap upwards. Data covering the Comparative Advantages Revealed (Table I.4.) nevertheless mirrors a deterioration in the competitive edge of these segments during the second half of the 1980s.

- Another sector whose exports rose appreciably was Chemicals and Petrochemicals, which increased to 6.7% of total foreign sales, doubling the face value figures of exports between 1975 and 1993.

[9] In 1980 iron ore accounted for 61% of steel products exports, falling to 33% in 1993.

- The Leather and Footwear group also featured positive developments, doubling its share of the export lists throughout the period in question.

- Pulp and Paper increased during the entire period. It should be noted that until 1980 Brazil was a net importer in this sector.

The diversification process is noted not only in the list of exports as a whole but also among the groups.[10] This fact is fairly clear in the food product group, where traditional products such as coffee and cotton lost ground to other products such as meats, soybeans and soy products, as well as orange juice.

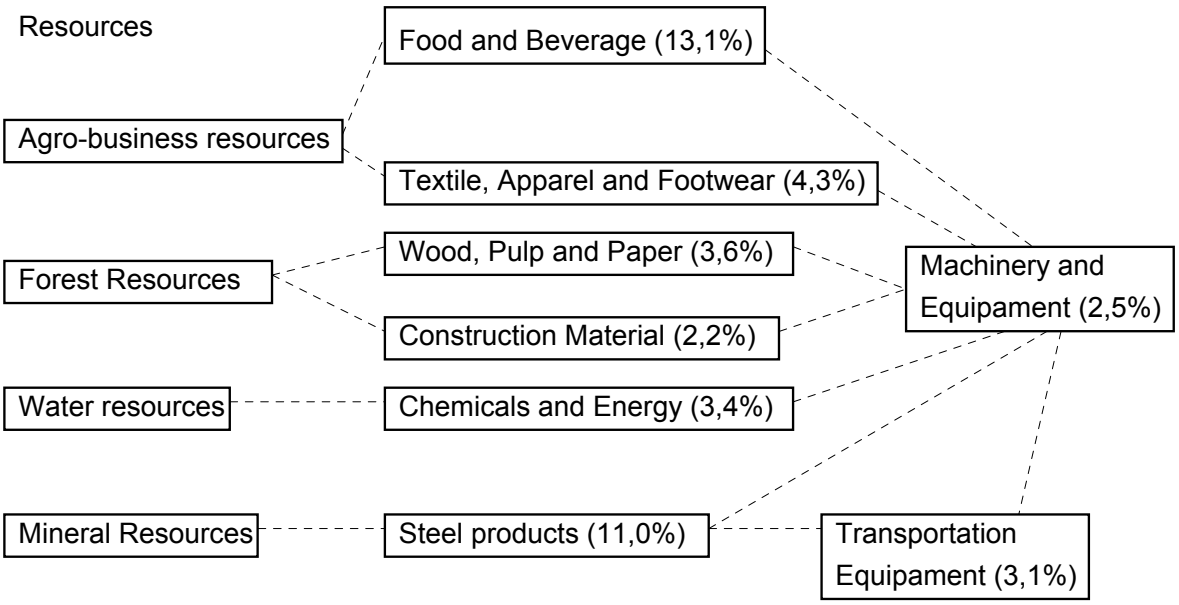
The specialization pattern of Brazilian exports highlights the concentration of natural resources-intensive products, as well as scale- and/or labor-intensive groups. Although the nation has progressed in expanding its output and exporting products with a higher added value, it has done so based on *static* comparative advantages: the abundance and consequent low cost of raw materials and energy allows industries located close to the *natural bases* to operate more competitively on the international market. Taken into consideration here are: forest and water resources, mineral deposits, and agricultural wealth. Table I.4 shows the sectors with comparative advantages whereby the Revealed Comparative Advantages Indicators – RCAI>0 means those which are natural resource-intensive, with the exception of transportation materials.[11] Even within the groups, more impressive comparative advantages may be identified in segments making more intensive use of natural resources, as is the case of the paper and printing complex. In the case of water resources, the supply of hydroelectric power is included, which, as seen below, constitutes a major source of cost advantages.

The Graph below lays out the structure of the Brazilian export list according to the type of natural resource used. It confirms, through Brazil's share of the international markets (percentages are indicated in brackets), that the nation is more active in sectors where natural resources are used more intensively.

[10] Bacha (1993), based on Araújo Jr. et allii (1991) uses the number of items in the NBM to demonstrate the diversification of the export list in various markets. In almost all sectors there was an appreciable increase in the variety of products exported – the number of NBMs almost doubled between 1974 and 1991.

[11] This is a typical example of a scale- and labor-intensive sector, as shown by the indicators developed by Nonnenberg (1991).

Graph 1



Source : BNDES – op. cit. Note : The percentages in brackets correspond to the participation of exports of principal Brazilian products of each world export grouping.

Of the sectors which comparative advantages are clear-cut, some have obviously benefited from investment programs underwriting the installation of plants with high production scales. Due to the size of the domestic market, these scales allow costs to be cut lower than those of its competitors. Additionally, the low costs of labor factor tends to contribute to specialization in labor intensive sectors.[12]

The Revealed Comparative Advantages Indicators (RCAI) show that, with the exception of Chemicals and the Ore-mining Industry, the other sections feature positive indicators. The competitive stance of most sectors however, was more favorable until 1985, reflecting the negative effects of the unstable economic situation on the performance of Brazil's exports sector.

[12]Nonnenberg (1991) shows that labor-intensive activities feature an RCVI higher than capital-intensive activities (p.19). He also shows that the labor content of exports is higher than capital intensity.

Table I.4

Revealed Comparative Advantages[1]

Sector	1976	1980	1985	1989	1991
General Industry	-5.48	2.37	0.87	-0.58	0.08
Ore-mining	-12.86	-30.54	-31.57	-14.78	-7.79
Processing Ind.	7.38	32.9	32.43	14.2	7.87
Civil Construction	0.90	1.98	1.21	1.19	0.99
Proc. Non-Metal Minerals	*-0.13*	*0.21*	*0.24*	*0.17*	*0.06*
Timber	*0.94*	*1.65*	*0.84*	*0.94*	*0.84*
Furniture	*0.09*	*0.12*	*0.13*	*0.08*	*0.09*
Metal-Mechanical	-19.50	-3.30	3.45	1.02	3.30
Metallurgy	*-4.32*	*-0.92*	*6.52*	*8.46*	*9.48*
Mechanics	-9.95	-3.73	-2.21	-5.04	-5.12
.Electric & Communications Mat	-4.98	-2.70	-4.10	-5.76	-3.29
Transportation Material	*-0.25*	*4.05*	*3.24*	*3.35*	*2.23*
Paper & Printing	-0.70	1.51	1.17	1.55	1.27
Paper & Cardboard	*-0.55*	*1.57*	*1.23*	*1.77*	*1.52*
Publishing & Printing	-0.15	-0.07	-0.06	-0.22	-0.25
Chemicals	-3.20	-0.29	2.86	-3.62	-5.73
Rubber	*-0.24*	*0.03*	*0.21*	*-0.21*	*0.08*
Chemicals	-2.13	-0.15	2.84	-2.00	-4.50
Pharmaceuticals	-0.66	-0.51	-0.58	-1.47	-1.13
Toiletries	-0.07	0.11	0.01	-0.01	-0.08
Plastic Material Prod.	-0.10	0.23	0.38	0.07	-0.11
Textiles & Footwear	4.92	6.28	5.89	4.08	3.84
Textiles	*2.32*	*3.46*	*2.38*	*1.26*	*1.13*
Apparel	*1.88*	*2.20*	*3.27*	*2.62*	*2.59*
Leather & Hides	*0.72*	*0.62*	*0.23*	*0.19*	*0.12*
Agri-business	26.10	27.55	18.96	11.35	5.90
Foodstuffs	*25.25*	*26.44*	*17.81*	*10.64*	*4.76*
Beverages	-0.41	-0.28	-0.33	-0.38	-0.47
Leaf Tobacco	*1.27*	*1.39*	*1.48*	*1.09*	*1.61*
Miscellaneous	-1.14	-0.83	-1.09	-1.37	-1.69

Notes: (1) Indicators calculated by Bacha (1993) with methodology used by Nonnemberg (1991) and developed by Lafay (1990).

RCAI = 1000/GNP[(Xik – Mik) – (Xik + Mik / Xi + Mi).(Xi – Mi)]
---------- (a) ---------- ---------- (b) ----------

where Mik and Mi represent, respectively, imports of product k by country i and total imports of country i. Xik and Xi have the same previous meaning concerning exports. The sense of this indicator is evaluating the product's contribution to the trade balance. The member (a) of the equation shows the product's effective balance of trade while the member (b) represents the neutral balance. Neutral balance by product is understood as the balance which would occur if the participation of each good and the total balance (Xi – Mi) were equal to its participation in the total trade flow (Xik+Mik/Xi+Mi). The signal of RCAI will be positive or negative (advantage or disadvantage) dependent on the effective balance being major or minor than the neutral. The normalization of both members by GNP is aimed at eliminating the bias caused by the intra-industrial trade evolution.

Source: DECEX. Prepared by: Bacha (1993).

I.3. Competitiveness

Some indicators of competitiveness demonstrate significant changes in Brazil's international position. In parallel to the diversification of this list, a consolidation in the competitive position of Brazil was noted, in reasonably dynamic markets such as the USA, the European Union, and more recently, Southeast Asia.

Latin America has recently been developing into a major market for Brazilian exports. Growth in sales to this region is linked to strengthening trade relationships under the aegis of the Mercosul Southern Cone Common Market, as well as to the economic growth noted in this region over the past few years.

Table I.5

Distribution of Brazilian Exports by Markets of Destination (%)

Markets of destination	1975	1980	1985	1990	1993
USA	15.42	17.42	26.53	24.6	20.7
IEC	27.82	27.15	23.99	31.4	25.9
LAIA	13.81	17.18	8.71	10.2	23.6
Mercosul	n.a.	9.0	3.86	4.2	13.9
ASIA*	9.89	9.87	12.38	16.8	15.9
Japan	7.75	6.12	5.44	7.5	6.0
Other countries	33.06	28.38	28.39	17.0	13.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: MICT/SECEX. Notes: * Excluding Middle East.

During the 1980s, Brazilian exports were basically channeled to three dynamic hubs of the world economy: Europe, the USA and Asia. It should be noted that there is a *certain specialization* in the sale of Brazilian products to each of these regions (see Table I.6.). European purchases are concentrated in traditional basic products – Food and Beverages, as well as Iron and Steel Products. The Asian countries show a strong demand for Semi-Manufactured Products, principally iron and steel goods, which account for 60% of exports to this region. Sales to the USA are diversified, although they were nevertheless strongly concentrated in manufactured products such as machinery, equipment and footwear, as well as semi-manufactured products such as steel goods.

For Latin America, there is a marked predominance of manufactured products. In these markets, transportation materials, machinery and equipment account for over 43% of Brazilian exports.

The geographical distribution of Brazilian exports to a large extent determines its vulnerability to non-tariff barriers and more particularly to environmental constraints. In the case of Europe, where environmental legislation is more stringent, the concentration of exports in natural resource intensive-products – as well as in mature industries – suggests that the nation may well be targeted by restrictive environmental norms and standards (see Table I.6.). The other extreme case is found in the Latin American markets where most exports are concentrated in manufactured products with a relatively lower level of natural resources (see Graph 1) in addition to environmental requirements being far less strict in these countries.

Some Brazilian export sectors, as will be seen in the course of this Report, are already coping with trade restrictions prompted by environmental issues. In these cases, the geographical distribution of their markets is highly relevant.

Table I.6

Brazilian Exports by Destination and Product Groups – 1993 (% of each region)

Product Groups	EUROPE[1]	USA	LAIA	ASIA[2]
Food & Beverages	42.27	14.54	7.08	17.25
Leaf Tobacco	4.26	2.37	1.22	0.77
Metallurgy & Iron/Steel	19.15	16.66	17.02	60.29
Machinery & Equipment	5.93	18.87	21.13	3.08
Transportation Material	3.78	6.81	22.20	3.83
Chemical Industries	3.96	5.10	12.21	4.99
Leather & Footwear	5.49	18.51	1.29	2.67
Textiles	3.20	4.51	5.39	1.39
Pulp and Paper	4.13	3.74	4.35	4.25
Sub-Total	92.18	91.10	91.87	98.51
Other	7.82	8.90	8.13	1.49
Total	**100.00**	**100.00**	**100.00**	**100.00**

Source: MICT/SECEX. Prepared by: FUNCEX.
Notes: (1) European Union. (2) Japan, China, South Korea, Taiwan, Hong Kong.

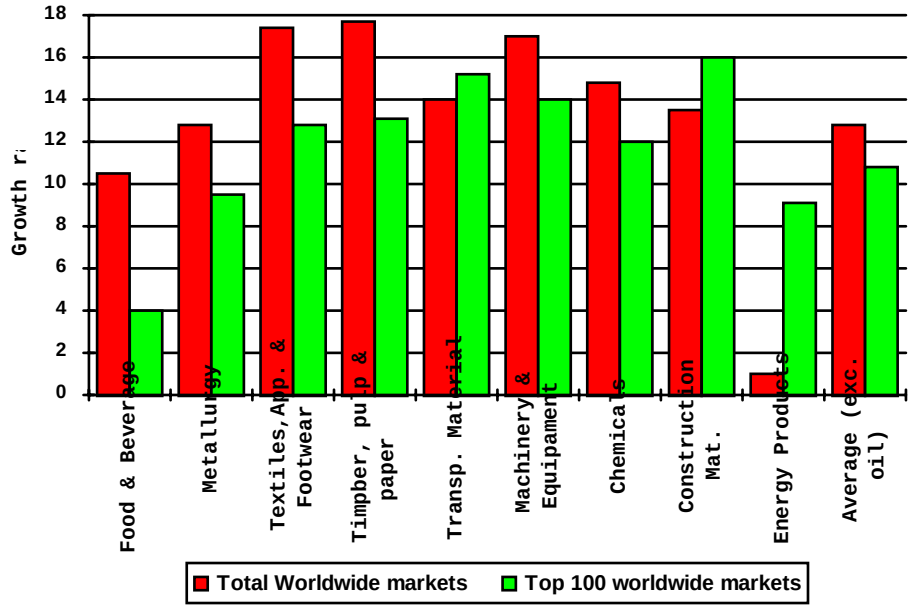
It should be noted that the Brazilian industries more strongly involved in international markets are characteristic of the Second Industrial Revolution: iron, steel and petrochemicals. They are often located in less dynamic markets with stiff competition, including from other niches. The most dynamic international markets currently lie in those sectors where it is possible to induce product differentiation and where factors such as knowledge are relevant – this is the case of products characteristics of the Third Industrial Revolution, whose production base is strongly linked to microelectronics. In these sectors, Brazil is not present: the technological content of the most important products on Brazil's list of exports is relatively low.

In a recent (1993) report, Brazil's National Social and Economic Development Bank (BNDES) compared the world imports growth rates by industrial groups with the variation rates of world imports of the 100 principal products on Brazilian exports between 1985 and 1990. This spotlighted the participation of Brazil in the less dynamic markets in each sector (see Graph below).

The intra-sectorial composition underlines the fragile competitive edge of Brazilian exports, which makes it more vulnerable to the impact of any measures corresponding to an increase in production and marketing costs.

Graph 2

Worldwide Export Growth Rates - 1985 – 1990



Source: United Nations. Prepared by: BNDES (1993).

I.4. Intensity of natural resources

The importance of natural resources to the competitiveness of Brazilian products is shown in Table I.8. and I.9 below. First, it should be noted that of the 20 products most intensive in natural resources, only one – Oil Refining – does not form part of Brazil's major export groups given in Table I.3.

Another observation based on Table I.9. is that, for products making the most intensive use of natural resources, the Revealed Comparative Advantage Indicator is appreciably higher than those for the less intensive products. This difference remains evident when the sample of ten products with a higher Direct Natural Resources Coefficient – DNRC is expanded to twenty. It should also be noted that when we separate out the less intensive products and increase the sample from ten to twenty, the RCAI rises appreciably. Additionally this increase (variation) is far higher than the percentage reduction in the RCAI between the ten most intensive and twenty most intensive. In other words, the group of products making limited use of natural resources is relatively small, indicating the importance of this factor in the competitiveness of Brazilian exports.

Finally, the indicators show that the comparative advantages of Brazilian exports have been reduced over the course of the decade, although the *correlation* between competitiveness and the intensity of natural resources has been maintained.

Table I.8

Natural Resources Intensity – Brazilian Industry

	Product	Direct Natural Resources Coefficient [1]
1	Wheat grinding	2.5731
2	Oil refining	0.7342
3	Poultry slaughtering & preparation	0.7153
4	Rice processing	0.7087
5	Livestock slaughtering & meat preparation	0.6219
6	Unrefined vegetable oils fabrication	0.5632
7	Coffee industry	0.5312
8	plant-based products processing	0.5152
9	Milk & milk products cooling & preparation	0.4693
10	Sugar industry	0.3653
11	Alcohol distillation	0.3303
12	Animal fodder preparation	0.2793
13	Juices, fruit & vegetable concentrates preparation	0.2759
14	Timber industry	0.1768
15	Tobacco industry	0.1726
16	Natural textile fibers processing & fabrics	0.1257
17	Non-ferrous metallurgical products	0.1186
18	Fabrication of non-metal mineral products	0.1089
19	Pulp fabrication	0.1088
20	Beverage industry	0.0954

Source: FIBGE. Prepared by: Nonnenberg (1991).

Note: (1) The Direct Natural Resources Coefficient – DNRC has the objective of examining the level of elaboration found in each industrial activity. Such coefficient was calculated based on data from the input-output matrix (1980). It measures, for each industrial activity, the participation of agricultural & cattle-raising products and extraction industries at the total intermediate cost of each activity. The coefficient major than 1 found for wheat milling is due to the fact that the sector's data were distorted by expressive subsidies given to that activity in the year considered.

Table I.9

Direct Natural Resources Coefficient by Comparative Advantages Index*

Activities, by resources intensity	RCA 88	RCA average 1980/88
10+	0.2555	0.2685
10-	0.0306	0.0189
20+	0.2165	0.2499
20-	0.1173	0.0803

Prepared by: Nonnenberg (1991).

Note: * Average weighted by participation in foreign trade of the Direct Natural Resources Coefficient of activities, arranged in accordance with the Comparative Advantages Index.

I.5. Energy

In general, Brazilian industry is energy-intensive. Through comparisons with various countries, shown in Table I.10, it may be noted that there is an international trend towards: i) reduction of industrial energy consumption with the exception of Mexico and Australia; ii) rising electric power consumption as a source of energy and iii) a drop in the domestic energy supply compared to the GNP. These indicators highlight attempts to rationalize power consumption as a characteristic of the stage of development of industry. Today, in more advanced economies, there is a powerful drive towards conservation, which is partially explained by difficulties in obtaining energy.

Table I.10

Energy Consumption – International Data

Countries	Energy Consumption in Industry/GNP MJ/US$ (1985)			Electricity Consumption in Industry/GNP MJ/US$ (1985)			Domestic Energy Supplies/GNP MJ/US$ (1985)		
	1970	1980	1990	1970	1980	1990	1970	1980	1990
USA	6.7	5.3	4.0	0.71	0.76	0.67	24	21	18
Canada	7.7	8.0	6.1	1.78	1.64	1.51	29	27	22
Australia	3.7	3.9	5.1	0.46	0.59	1.14	13	14	19
France	5.6	4.3	3.0	0.75	0.71	0.68	17	16	15
Germany	7.9	6.0	4.1	1.25	1.07	0.92	28	23	19
Italy	6.2	4.5	3.7	0.88	0.85	0.81	17	15	13
UK	10.4	6.4	4.5	0.99	0.89	0.79	26	20	17
Japan	7.2	4.9	3.5	1.19	1.03	0.87	16	14	11
Spain	6.0	6.1	5.0	0.93	1.26	1.14	15	19	18
Israel	4.3	3.5	2.9	0.58	0.62	0.66	17	16	16
Taiwan	10.0	8.6	5.1	1.80	1.83	1.27	22	21	14
Korea	6.5	11.6	10.1	0.69	1.37	1.42	28	30	26
Mexico	8.0	8.6	10.2	0.67	0.78	1.19	27	30	27
Chile	5.8	6.0	5.6	1.00	1.10	1.32	22	20	22
Brazil	7.3	7.1	7.1	0.74	1.14	1.60	27	21	23

Source: World Energy Council – Report 1992 – International Energy Data.

For Brazil, the stability of industrial energy consumption compared to the GNP contrasts with rapid growth in electric power consumption, which is higher than the growth rate for other countries. In fact, electric power consumption data highlights the transformation in Brazil's energy grid. Electric power[13] currently accounts for some 50% of final industrial consumption (see Table I.11) against 32% in 1975. The construction of major hydroelectric plants throughout the 1970s has buttressed an appreciable increase in supply, at lower prices, making energy one of the cost advantage factors for Brazilian companies.[14]

13 In Brazil, 87% of electric power is generated hydric resources.

14 In a study on the Brazilian iron and steel industry, BNDES (1987) surveyed international production costs. The sectors where Brazil enjoyed greater advantages were energy and iron ore.

Table I.11

Energy Consumption/Industrial Sector – by Source (%)

Industrial Sector	1975	1980	1985	1990	1992
Natural gas	0.5	0.6	1.0	2.0	2.4
Steam coal	0.3	0.9	2.5	1.5	1.4
Fuel-wood	11.0	6.8	10.5	8.1	6.7
Cane bagasse	10.7	9.3	8.2	6.8	7.9
Other primary renewable sources	0.8	1.4	1.9	2.2	2.5
Fuel oil	28.7	25.1	8.9	10.0	10.3
Coking plant gas	0.7	1.0	1.3	1.3	1.3
Coal-coke	4.8	6.2	8.1	7.7	9.0
Electricity	32.5	38.9	46.6	49.6	49.7
Charcoal	7.7	6.5	8.5	8.1	6.2
Other	2.3	3.3	2.6	2.7	2.6

Source: Brazilian Energy Matrix.

Changes in the energy grid indicate that environmentally-harmful “dirty” energy sources – such as fuel-oil, fuel-wood and charcoal – are being replaced by “cleaner” sources such as electric power and natural gas.

Among these sectors, the pig-iron and steel producers are the largest end-users of power, accounting for 22% of industrial consumption (final) of power. The most important sources are coking coal, electric power and charcoal. Other sectors with a large share in industrial power consumption are: Food and Beverages (17%); Non-Ferrous and Other Metals (13%); Chemicals (10%); and Pulp and Paper (8%).

These sectors, although major energy consumers, feature very different energy grids. Pig-iron and Steel as well as Food and Beverages consume relatively less hydroelectric power (Table I.12); Non-Ferrous and Other Metals, Chemicals, Pulp and Paper make intensive use of electric power, that is close to or higher than the industrial average. The largest users of energy from plant sources are : Iron and Steel, consuming 79% of charcoal- produced energy, followed by Food and Beverages, Ceramics and Pulp and Paper, accounting for 38%, 29% and 14% respectively of industrial consumption of fuel-wood(see Table I.13).

Table I.12

Industrial Energy Consumption by Sector, by Source
(% total consumed by each sector, by energy source)

Sector	Diesel Oil	Comb Oil.	Natural Gas	Coal	Fuel-wood	Coal-Coke	Electricity	Char-coal	Sub-Total
Industry – Total	0.5	10.3	2.4	1.4	6.7	9.0	49.7	6.2	86.2
Cement	0.4	38.0	1.6	16.2	0.0	0.0	33.1	8.0	97.3
Pig-iron & Steel	0.2	2.8	2.5	0.0	0.0	39.2	25.8	22.2	92.7
Iron alloys	0.0	0.0	0.5	0.0	0.0	1.6	82.3	15.2	99.6
Mining & Palletizing	3.0	19.9	2.5	0.9	0.0	4.3	68.0	1.2	99.8
Non-ferrous & other metals	0.0	4.3	0.3	0.0	0.4	0.7	88.0	2.2	95.9
Chemicals	0.4	23.6	5.9	2.3	2.5	0.0	55.5	0.4	90.6
Food & Beverages	0.2	7.2	1.4	0.7	15.4	0.0	28.2	0.0	52.1
Textiles	0.1	16.6	2.9	0.1	4.2	0.0	75.5	0.1	99.5
Pulp & Paper	0.3	11.0	1.3	1.9	11.7	0.0	45.2	0.0	71.4
Ceramic	0.3	18.1	3.4	2.4	52.1	0.0	19.6	0.3	96.2
Others	1.7	10.7	4.4	1.2	7.4	0.0	73.2	0.1	98.7

Source: Brazilian Energy Matrix.

Table I.13

Industrial Energy Consumption by Source, by Sector
(% total consumed by industry, by each sector)

Sector	Diesel Oil	Comb. Oil	Natural Gas	Coal	Fuel-wood	Coke Coal	Electric-ity	Char-coal	Sub-Total
Cement	3.19	13.63	2.38	43.80	0.02	0.00	2.45	4.73	3.69
Pig-iron & Steel	11.18	5.98	22.97	0.54	0.00	96.53	11.52	79.24	22.19
Iron alloys	0.00	0.00	0.79	0.00	0.00	0.70	6.45	9.54	3.90
Mining & Palletizing	24.28	7.17	3.84	2.37	0.00	1.75	5.06	0.71	3.70
Non-ferrous & other metals	0.00	5.68	1.83	0.00	0.74	1.01	23.84	4.73	13.46
Chemicals	7.99	23.83	25.35	17.26	3.86	0.00	11.59	0.62	10.37
Food & Beverages	6.71	11.65	9.93	7.98	38.19	0.00	9.49	0.00	16.73
Textiles	0.96	5.63	4.20	0.32	2.18	0.00	5.28	0.05	3.48
Pulp & Paper	5.43	9.09	4.69	12.08	14.68	0.00	7.71	0.00	8.47
Ceramics	2.24	6.64	5.24	6.58	29.14	0.00	1.49	0.17	3.77
Others	38.02	10.69	18.77	9.06	11.19	0.00	15.11	0.21	10.27
Industry – Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Brazilian Energy Matrix.

I.6. Pollution and industry

Estimates of pollution abatement in Brazil reveal that industrial output accounts for an appreciable proportion of pollutant emissions. The considerations below seek to outline a general framework of pollution abatement procedures in practice by Brazilian industries.

Control of water pollution may be seen in the indicators covering the discharge of organic matter (measured in DOB) as well as that covering the discharge of heavy metals.

With regard to the discharge of organic matter, industry controls 75% of potential emissions, indicating the pollution level that which would be generated in the absence of any controls. The remaining 25% of industrial discharge is responsible for 60% of organic water pollution, against 40% due to domestic sewage. Based on Table I.14, it may be noted that the food and beverage, metallurgical and chemical sectors are those with the highest percentage reduction in discharges. Nevertheless, food, beverages and chemicals, together with pulp and paper, leathers and hides, as well as pharmaceuticals, constitute the sectors that produce the largest volumes of organic pollution, just as they also feature the highest intensity of remaining pollution (remaining pollution/GNP of the sector).

The water pollution indicators show that among the most heavily polluting sectors there are some important exports. On the other hand, these are also those with the best control figures (pollution abatement rates) which, when comparing remaining pollution with potential pollution, indicate the level of efforts made by these firms to reduce pollution.[15] This fact suggests that participation in international markets leads companies to use cleaner technologies or instigate more stringent pollution controls.

Water pollution by heavy metals is due almost completely to industrial production, with abatement of this type of discharge reaching 60%. It should nevertheless be mentioned that the high levels of abatement in this case are associated with the nature of this type of treatment, which is almost a by-product of processing organic discharges. This fact explains the coincidence in the performance of the sectors in both types of water pollution, as well as the fact that sectors with higher pollution abatement rates are not always the heaviest polluters (see Table I.15). An analysis by sector reveals that metallurgy, as well as leather and hides, account for 80% of these discharges, with abatement rates close to the national average. They also feature remaining pollution rates that are far higher than those for other industrial sectors. The food, pulp and paper, timber and chemical sectors, although potentially far less polluting, feature abatement rates above the national rates.

15 The pollution indicators (potential, remaining, abatement rate and intensity) here presented and commented were calculated by Seroa da Motta (1993) and were defined as such: “the abatement indicator is the ratio of the remanescent pollution level to potential pollution level. Potential pollution level is the load level discharged by a plant without any treatment. Remanescent pollution level is the actual discharge after treatment. In the case of a industrial plant, potential level will vary according to production process and technology. Remanescent level will be the level of pollution still emited despite the abatement equipments installed in the plant. Abatement indicators do not offer an indication of the environmental intensity of the output produced that is, how much additional pollution is bound to generate and additionsl unit of income. Pollution intensities for industrial sectors were determined dividing potencial or remanescent pollution level by industrial output. The database on pollution emission and abatement was obtained from PRONOCOP (Brazilian National Program of Pollution Control), a 1988 World Bank project which covered São Paulo. Data were obtained in each state from EPA records based on files of controlled firms. Information on emission level in these files are, in most cases, calculated from technical parameters based on the existing production and abatement technologies.”

Table I.14

Water Pollution by Emission of Organic Loads (DOB)
Industrial Sector Rankings by Selected Indicators (1988)

	Potential Pollution[1]	Remaining Pollution[2]	Pollution Abatement Rate[3]	Intensity (g/US$) Average Sectorial 18.2%
1	Food	Leather & Hides	Food (85 %)	Leather & Hides (878.2)
2	Chemicals	Chemicals	Beverages (80%)	Food (139.1)
3	Leather & Hides	Food	Metallurgy (79%)	Pharmaceuticals (59.9)
4	Beverages	Beverages	Chemicals (78%)	Beverages (32.1)
5	Pulp & Paper	Pharmaceuticals	Pulp & Paper (71%)	Chemicals (27.5)
6	Pharmaceuticals	Pulp & Paper	Leather & Hides (54%) Pharmaceuticals (21%)	Timber (20.6) Pulp & Paper (17.0)

Prepared by: FUNCEX. Source: Seroa da Motta (1993).
Notes: (1) Potential Pollution: Pollution generated under the hypothesis of no abatement whatsoever.
(2) Remaining Pollution: Potential Pollution – Pollution under Abatement.
(3) Removal Rate: Pollution under Abatement / Potential Pollution.
(4) Intensity: Pollution/GNP of the sector.

Table I.15

Water Pollution by Emission of Heavy Metals
Industrial Sector Rankings by Selected Indicators (1988)

	Potential Pollution[1]	Remaining Pollution[2]	Pollution Abatement Rate[3]	Intensity (g/US$) Average Sectorial: 18.2
1	Leather & Hides	Leather & Hides	Food (96%)	Leather & Hides (30.3)
2	Metallurgy	Metallurgy	Timber (85%)	Metallurgy (1.3)
3	Chemicals	Mechanics	Pulp & Paper (85%)	Mechanics (0.1)
4	Mechanics	Chemicals	Chemicals (74%)	Electrical Material (0.1)
5	Transportation Mat.	Transportation Mat.	Transportation Mat. (63%)	Timber (0.1)
6	Electrical Material	Electrical Material	Leather & Hides (62%) Metallurgy (58%)	Chemicals (0.1) Textiles (0.1)

Source: Seroa da Motta (1993). Prepared by: FUNCEX.

Air pollution is basically due to automotive sources.[16] An analysis of the emission and abatement of air pollutants by Brazilian industry reveals that only particulate and hydrocarbons are subject to reduction. Sulfur Dioxide (SO_2), Nitrogen Oxide (NOx) and and Carbon Monoxide also feature negligible abatement rates throughout industry as a whole.

With regard to particles, the Non-Metallic Minerals and Metallurgy sectors account for 80% of industrial emissions. Their abatement rates over around 60%, and consequently result in remaining pollution rates that are appreciably higher than the national average. With regard to the abatement of particulate emissions, the best indicators are those found in the mechanics, pulp and paper, electrical materials and transportation equipment sectors.

16 There are no consolidated data for Brazil providing participation of sources (industrial and automotive) and air pollution. Nevertheless, estimates of CETESB (1991) regarding the metropolitan area of Sao Paulo review that 51% of particulate emissions and 30% of sulphurated emissions are from industrial sources. In regard to others air pollutants as Nox, Hc e CO2 ,the industrial participation does not reach 10%. Seroa da Motta (1993).

Table I.16

Air Pollution by Particles, Sulfur Dioxide and Nitrogen Oxide
Industrial Sector Rankings by Selected Indicators (1988)

I- Particles				
	Potential Pollution[1]	**Remaining Pollution[2]**	**Pollution Abatement Rate[3]**	**Intensity (g/US$)** Sectorial Average 41.34
1	Non-Metal Minerals	Non-Metal Minerals	Mechanics (81 %)	Non-Metal. Minerals (261.4)
2	Metallurgy	Metallurgy	Electrical Material (79%)	Metallurgy (111.4)
3	Chemicals	Food	Pulp & Paper (79%)	Beverages (58.2)
4	Pulp & Paper	Chemicals	Transportation Mat. (75%)	Timber (42.1)
5	Food	Textiles	Non-Metal Min.(62%)	Pulp & Paper (28.2)
6	Textiles	Pulp & Paper	Chemicals (56%) Metallurgy (55%)	Textiles (24.25)
II – Sulfur Dioxide				
	Potential Pollution[1]	**Remaining Pollution[2]**	**Pollution Abatement Rate[3]**	**Intensity (g/US$)** Sectorial Average 31.95
1	Food	Food	Transportation Mat. (26%)	Food (72.5)
2	Chemicals	Chemicals	Chemicals (3%)	Chemicals (59.9)
3	Metallurgy	Metallurgy	Pharmaceuticals (3%)	Non-Metal. Min.(51.0)
4	Non-Metal Minerals	Non-Metal Minerals	Textiles (2%)	Metallurgy (50.7)
5	Textiles	Textiles	Rubber (1%)	Beverages (35.7)
6	Pulp & Paper	Pulp & Paper	Leather & Hides (1%)	Perfumes. Soaps & Candles (32.3)
III – Nitrogen Oxide				
	Potential Pollution[1]	**Remaining Pollution[2]**	**Pollution Abatement Rate[3]**	**Intensity (g/US$)** Sectorial Average
1	Chemicals	Chemicals	n.a.	Chemicals (45.6)
2	Metallurgy	Metallurgy	n.a.	Pulp & Paper (32.5)
3	Pulp & Paper	Pulp & Paper	n.a.	Beverages (17.4)
4	Food	Food	n.a.	Metallurgy (17.2)
5	Non-Metal Minerals	Non Metal Minerals	n.a.	Textiles (11.2)
6	Textiles	Textiles	n.a.	Timber (9.7)

Source: Seroa da Motta (1993). Prepared by: FUNCEX.

The discharge of hydrocarbons is concentrated almost totally (90%) in the Chemical sector (principally oil-refining plants), which also maintains a high rate of remaining pollution (see Table I.17). With regard to the emission of Sulfur Dioxide, the food, chemicals non-metallic and metallurgy sectors are the heaviest polluters, while also featuring the most intensive remaining pollution levels. The largest emissions of Nitrogen Oxide are found in the chemical, metallurgical, pulp and paper and food sectors. The metallurgical sector accounts for most air pollution by Carbon Monoxide. Similarly, within this context the metallurgical sector features a remaining pollution rate far higher than that noted for the Brazilian industry as a whole (see Table I.17).

A comparison with international indicators shows that the intensity of the remaining pollution in Brazilian industry identified in 1988 (SO_2 and NO_x) is approximately six times higher than that of the European average

in 1980.[17] Still considering air pollution, it worth noting that the emission of sulfated materials is due principally to burning fuels by automotive vehicles. In the case of the emission of other relevant pollutants, such as Carbon Dioxide, which reduction is associated with a reversal of the greenhouse effect, this is due largely to forest clearing (the volume of CO_2 caused by this factor is seven times greater than that of emissions from energy-producing sources, given the importance of hydroelectricity in Brazil's energy grid). In terms of industrial emissions, Brazil is in a comfortable position considering its emission of CO_2.

Although the participation of Brazil's export sectors in air pollution is lower than for water pollution, their performance is nevertheless good with regard to pollution abatement.

Table I.17

Industrial Sector Rankings for Hydrocarbons (HC) and Carbon Monoxide(CO) 1988

	HC (g/US$)	CO (g/US$)
	Sectorial Average: 4.32	**Sectorial Average: 151.4**
1	Chemicals (18.37)	Metallurgy (1214.93)
2	Metallurgy (6.21)	Timber (90.27)
3	Timber (2.90)	Pulp & Paper (37.94)
4	Mechanics (2.03)	Chemicals (17.04)
5	Electrical Material(1.55)	Beverages (12.73)
6	Pulp & Paper (0.69)	Textiles (3.75)

Source: Seroa da Motta (1993).

I.7. CONCLUSIONS

In a recent report, Mollerus (1994) analyses the potential impact of imposing environmental constraints on the competitiveness of products exported by the Latin American Economic System – LAES. To do so, the Revealed Comparative Advantage Indicators – RCAI[18] and the weight of exports in the so-called polluter industries are examined.

Mollerus defines “polluting industries” as those that have the highest level of pollution abatement and control expenditures”.[19] For the LAES group of countries, the exports of these industries account for 47% of total manufactured goods sold abroad (1990 data) and enjoy a good competitive position – the RCAI rose throughout the 1980s. For Brazil, the participation in its list of exports of the products mentioned

17 Non-consolidated data per industrial sectors, which would allow sectorial comparison, are not available.

18 The RCVI calculated by Mollerus (1994) is that defined by Balassa, from which the indicator given here is derived.

19 To identify these industries Mollerus used data reported in the US Bureau of Census publications : Manufacturers’ Pollution Abatement Capital Expenditures and Operating Costs (1988). The references, thus are data of pollution abatement and control expenditures of United States manufacturing industries. In this case the definition of “dirty industries” refer to the potential pollution and not to the remaining one. For several industrial sectors, highest level of pollution abatement and control expenditures are used as indicators of high level of potencial production. As a consequence, “dirty industries” may be effective sources of pollution, or not, depending on the effective control rates adopted by each country or region (USA, Japon, SELA countries etc.). Per Mollerus’criteria, “dirty industries”are : ferrous metal products (SITC 67), non-ferrous metal products (SITC 68), metal goods (SITC 69), pulp and paper products (SITC 251), organic and inorganic chemicals (SITC 512,513 and 514), radioactive materials (SITC 519), mineral tars and petrochemicals (SITC 521), manufactured fertilizers (SITC 561), paper, cardboards and related products (SITC 641 and 642), timber and timber products (SITC 631 and 632), agricultural chemicals (SITC 599) and cement (SITC 661).

increased between 1975 (21.6%) and 1990 (44.4%). Taking the RCAIs presented before for Brazil (Table I.4) it may be noted that in general (as the classifications are different) and with the exception of goods produced by the chemicals complex and radioactive materials, "polluting" Brazilian industries have comparative advantages. In the case of countries such as the USA and Japan, the participation of polluting industries exports on sales of manufactured products is respectively 17.8% and 11.0%.

These results confirm the indications given in the course of this work that, in function of the characteristics of Brazilian exports, the nation is a potential target for environmental constraints. This makes it important to note that Brazilian exports make intensive use of natural resources and energy which, as mentioned – given the nation's industrial energy grid – also means intensive use of water resources (hydroelectric power). Additionally, the data indicate a positive correlation between competitiveness and intensity of use of natural resources. Information on pollution also highlights export sectors as being among the most heavily polluting, although they show greater concern with water pollution abatement and to a lesser extent air pollution abatement.[20]

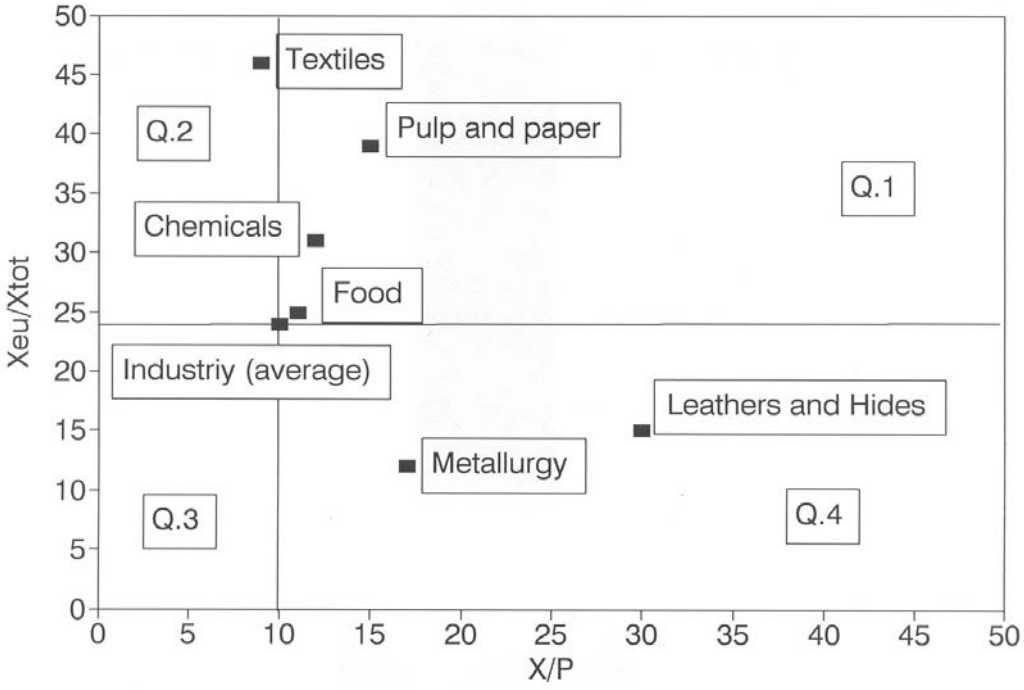
Furthermore, the combination of the standard of specialization of the export list and its geographical distribution, as shown in Table I.6, indicates a delicate situation for Brazil: sectors sensitive to the imposition of environmental constraints have as their markets of destination major nations where environmental standards and norms are more stringent.

Based on the survey of the characteristics mentioned above – intensity of use of natural resources, energy and pollution – it is noted that a large segment of Brazil's list of exports is *a priori* susceptible to the imposition of domestic environmental constraints. The vulnerability of these sectors rises in step with: i) the relationship between exports and production, and ii) the proportion of total exports earmarked for European markets. The following Graph shows a comparison between the average for Brazilian industry and the situation of some export sectors which, due to their inherent characteristics, are in a more delicate situation. The sectors found in section I – Pulp and Paper, Textiles and Chemicals – are the most vulnerable. In addition to presenting high export coefficients, the European Union absorbs a significant amount of their exports. Sectors located in sections II and IV are also in a more delicate situation compared to the Brazilian industry as a whole, although for different reasons. Leathers and Hides, and Metallurgy for example, are major exporters, although the participation of Europe as a market of destination is relatively minor.

20 As per Seroa da Motta 's criteria to define "dirty industries", that is, those which intensity of remaining (water and /or air) pollution , the Brazilian "dirty industries" would be: non-iron minerous, steel, paper and pulp, leathers and hides, chemical, pharmaceutical and food and beverages. This criteria has the advantage over Mollerus' of being based upon data of Brazilian industry and upon indicators of remaining pollution intensity, while Mollerus'criteria takes as "dirty industries" those which show high level of pollution abatement and control expenditures in the USA. It's important to note that the criteria used by Mollerus, although limited, is justified by the lack of data on industrial pollution control in Latin America. Despite it's limitation, it is capable of include the major part of "dirty industries" identified by Seroa da Motta.

Graph III

Vulnerability of Selected Sectors



Note: Export data by destination = 1993, data X/P = 1992

Various other factors that reinforce the idea of the potential vulnerability of Brazil to foreign regulations applicable to products and production methods include:

- Brazilian exports are price-takers on highly competitive international markets. This means that the nation's competitive edge is sensitive to any measures – even if not mandatory – that may boost its production costs. Furthermore, the fragile competitive insertion of products exported – Brazil's foreign sales are located in less dynamic market segments – increase this vulnerability to initiatives that might increased production costs.

- Brazil's principal export sectors base their comparative advantages on the easy availability of natural resources and large production scales, concentrating on the production of intermediate goods. These are sectors:
  - Whose economic characteristics, at the production level, offer low potential for the implementation of product differentiation strategies, which hampers the recovery through higher prices of possible future increases in production costs due to internalizing pollution costs; and
  - Which are characterized by high investments in property, plant and equipment, as well as indivisible technical and production aspects, which tend to boost the participation of the costs of

investments in technology reducing the use of natural resources or energy, in the total costs of adapting these companies to less polluting production models;

- As the Brazilian market is not at all demanding with regard to environmental criteria applied to production methods, it does not remunerate – through either prices or increased market share – corporate expenditures on environmental controls, and thus does not allow companies to offset even some of their environmental investment costs in sales to the domestic market, lifting some of the burden on exports;

- This gap between domestic and foreign environmental standards may well reduce the scope for the pressure from foreign environmental regulations to act as a "new source of permanent structural change", as well as the creation and maintenance of comparative advantages in environmentally-sensitive industries (Sorsa, 1993);

- Some Brazilian sectors exporting finished goods (textiles, footwear and paper) seem somewhat sensitive to regulations and environmental standards applicable directly or indirectly to production processes and methods – including product standards based on the analysis of the item's life cycle. This is because compliance with those standards presupposes and requires a close articulation and reasonable level of cooperation between input materials and exported goods. The fragility of relations between suppliers and producers in various production chains of the Brazilian industry and the presence of non-cooperative relations within those chains have been appointed as factors responsible for an important part of the Brazilian industry's competitive weakness. They would also be obstacles to the application of regulations and environmental patterns previously referred to.

- Despite the recent lifting of constraints on trade, the Brazilian economy has not yet eliminated its anti-exporter bias, which means that the competitive position of the Brazilian industry is fragile across the board. The country's macro-economic crisis and the use of foreign exchange rates as a tool to combat inflation has been gradually eroding the positions gained by Brazilian industry in international markets during earlier decades. This means that any foreign standard or regulation triggering an increase in production costs would affect the competitive edge of Brazilian industry more than proportionately, reducing the profitability of exports and blocking incentives to modernization for companies, as well as restructuring on environmental friendly bases.

Finally, it should be emphasized that the *threats* represented by international environmental standards and regulations would tend to become *effective and relevant* should they become applicable to production processes and methods (PPM standards). Non-mandatory constraints – such as ecolabelling schemes – involve an analysis of the entire life-cycle of the product, including assessment of the forms of use of raw materials and production processing methods. This analysis implicitly involves the appraisal of specific standards which are not only environmental but also technological and economic, or involving production and the interface between the various stages of the production chains. The characteristics of Brazil's list of exports suggests – and this is confirmed below – that constraints associated with the properties of the final products (such as the intensity of chlorine use in paper production) tend to produce

lesser impacts on Brazilian foreign sales than those involving analyses of the production process. The firming-up of the potential threats to Brazilian exports represented by foreign environmental regulations will to a large extent depend on the dissemination of standards covering production processes and methods – which may blunt the competitive edge of the country's exports – as well as, secondarily, on whether or not these regulations are mandatory. Obviously, a more marked trend on the part of consumers to opt for products produced by "clean" processes and production methods will increase any discriminatory effects, including those of non-mandatory standards.

This overview of the transformation of the potential threat of real discrimination is generalized, and does not depend on any analyses of the specific concrete effects of environmental regulations on Brazilian exports. It merely supplies generic criteria for identifying issues pertinent to this matter, for a country whose list of exports is concentrated in sectors that make intensive use of environmental resources in segments that are not particularly dynamic, operating in highly competitive areas on the OEDC markets. Due to their blunting effects on the competitive edge of Brazil's exports, standards assessing PPMs can materialize in a more effective manner the potential threat represented by environmental constraints.[21]

Analyses of this process of transforming a potential threat into real commercial discrimination may be based on case studies at the sectorial and/or corporate level, as well as on assessments of the impacts of specific regulations on all or part of the export lists of one or more countries. The FUNCEX study (1994) on ecolabelling schemes in the European Union and their impacts on Brazilian exports is an example of this latter type of analysis. It should be noted that the set of initiatives included under the tag of "foreign environmental regulations" is very heterogeneous and includes national regulations, international (multi-lateral) agreements, and voluntary national and regional certification schemes. The real and potential impacts of these initiatives depends largely on the motivation behind them, their level of enforcement, the specific characteristics of the export lists of various countries and sectorial characteristics, as well as at the corporate level. Any approach to this broad range of regulations demands case studies, focused either on sectors on specific regulations.

This report seeks to highlight the relevant variables necessary to turn a potential threat into real commercial discrimination. It also attempts to analyze the differentiated impacts of foreign environmental regulations on exports through an analysis of three Brazilian export sectors which are potential targets for environmental restrictions. It also seeks to analyze to what point, for the various sectors, foreign regulations – or alternatively other variables such as domestic environmental policy – constitute elements able to explain corporate and sectorial strategies of adjusting to a production paradigm compatible with environmental requirements. The conclusions given in Sections III are thus valid only for the sectors analyzed, although potentially pertinent policy issues may be identified involving Brazilian exports in general.

[21] Among the various eco-labelling initiatives, the handling of standards covering PPMs may increase or decrease the discriminatory potential of these schemes. In the case of Canada's Environmental Choice Program, the model in operation "does not require that foreign products meet its criteria, if processing or production takes place in the country of origin. However, if they are to qualify for the ecology, they must meet its environmental criteria on use and disposal" (Canada's EPC and its impacts on developing countries – Center for Trade Policy and Law – Carleton University and University of Ottawa, presented at UNCTAD workshop on Eco-labelling and International Trade – Geneva, June 28-29/1994).

II. Adjustment and business strategies of export sectors

Having examined the vulnerability of Brazil's list of exports to the imposition of foreign environmental standards and regulations, Part II of this work analyzes, on the basis of information collected from exporters, what environmental restrictions they have been faced with so far, as well as their expectations and strategies. As noted, this type of analysis may be carried out from two viewpoints: either starting out from specific legislation in order to examine their effects on selected sectors, or investigating in various sectors which genuine obstacles have arisen with regard to the environment. In this case, the sectors may or may not be faced with problems of this nature. This work follows the second alternative.[22]

The sectors selected were: Iron and Steel, Pig-Iron, and Pulp and Paper [23]. They have various common characteristics that justify this choice: i) markedly dynamic exports during the 1980s and early 1990s; ii) very intensive use of natural resources and energy; and iii) they are all potentially polluting sectors. Other common characteristics which should determine the extent and manner in which environmental standards affect exports are found in all three sectors.

Initially, a summary of Brazil's National Environment Policy, which has played an increasingly important role in shaping corporate strategies, is given. This is followed by comments on the importance of the environmental variable in industrial management. Finally, the sectorial studies are presented.

II.1. National environment policy[24]

The establishment of an autonomous environmental policy in Brazil started out on the basis of the country's National Environment Policy established by Law 6,938 issued on 31 May 1981, which concomitantly set up the National Environmental System, in order to implement this policy.

Law 6,938 buttressed the capacity of the public sector to intervene in environmental matters, fundamentally creating management tools based on commands and controls. Classified into four basic categories,[25] these tools defined the nature of Government actions in environmental management, essentially founded on the quantitative control of environmental goods and services. In this situation, the use of alternative and/or supplementary policy tools based on the use of economic incentives (market mechanisms) is still somewhat restricted and poorly disseminated.

The legal situation of nationwide validity created by Law 6,938 nevertheless does not prevent Brazilian States from legislating on environmental issues, provided that this does not run counter to the general guidelines laid down by federal legislation. A state government, under these circumstances, is assured relative autonomy, and

22 The other side (examination of specific European Union legislations) is given in another study carried out by FUNCEX "Os Esquemas de Ecollabeling na União Européia e seus Impactos sobre as Exportações Brasileiras".

23 In view of the difficulty in obtaining information from producers in the petrochemicals sector, due to the attitude of its representatives towards the survey, no study was made on this segment. On the other hand, some comments are made on the iron ore mining industry, thus completing the analysis of the iron and steel industry complex.

24 The comments on Brazilian National Environment Policy made here are based on Seroa da Motta (1991).

25 These categories are: a) environmental standards (covering quality and emissions); b) land use control (zoning and protected areas; c) pre-licensing Environmental Impact Study/Report); d) penalties (fines, compensation payments etc.)

may intervene to a large extent in the environmental management models to be practiced within each state. State governments are also responsible for the implementation of environmental laws, with the exception of a few specific situations, such as those involving areas of preservation or the country's heritage, as well as various types of licensing, authorization and pollution abatement.

Fostering the consolidation of autonomous environmental administration, the assembly of an institution or apparatus designed to implement Brazil's National Environment Policy was important. The National Environment System consists of the Government Council with representatives from all Ministries; an Advisory and Executive Council (CONAMA) made up of representatives of the States, the Central Government, non-government organizations and environmental specialists; a Central Agency forming a bureau under the presidency (SEMAN) and an Executive Agency (IBAMA). The National Environment System also includes other government agencies involved with environmental preservation as well as the environmental bureaus of the states and municipalities. In order to provide financial support for the National Environment Policy, the National Environment Fund was set up, administered by the National Environment System.

If for environmental issues both the general policy and budget are under the control of the Central Government, states and municipalities nevertheless play an important role in the National Environment System. In addition to being represented on the councils and boards, they have their own environmental legislation and in some cases also are endowed with powerful environmental agencies that can represent regional interests at the national level.

Until 1990, the administrative structure that had been under assembly since 1981 (Law 6,938) was under the command of a Ministry whose duties and responsibilities were not limited to administration of environmental policy. With the administrative reform undertaken by the Collor Government in 1990, this structure won its autonomy.

Although recent in both existence and autonomy, Brazil's National Environment Policy has achieved a relative success over the past few years. IBAMA has become more effective in controlling forest clearing and logging, while SEMAN has managed to strengthen consideration of environmental problems in government agencies, in addition to promoting initiatives designed to attract foreign investments to projects involving environmental issues. Some CONAMA regulations – such as that regarding the mandatory nature of an "Environmental Impact Study" for large-scale projects that involve sweeping changes in the environment, in addition to institutionalizing this tool and correcting the fact that these assessments had been carried out in an unsystematic manner, and only in some parts of Brazil, began effectively to introduce environmental concerns into corporate planning and management.

Law 6,938 makes the support of official financial institutions for company projects conditional on compliance with legislation in force. Along the same lines, the issue of regulations under this law (Decree 9927 issued on 6 July 1990) requires that government agencies specialized in credit and incentive management should shape their actions to environmental authorizations required under law. This circumstance strengthened the consideration of environmental issues both within these agencies as well as with their users. An example of this fact is clear in the appreciable growth shown by the environmental

variable within the National Social and Economic Development Bank – BNDES, the Brazilian Government's principal long-term credit agency with a budget of over US$ 3.0 billion per year. In addition to guaranteeing compliance with environmental requirements, the BNDES has encouraged the inclusion of programs to control the negative effects of economic activities on environment in quality and productivity programs of companies, as well as a possible acknowledgment of the synergy between production and environmental efficiency. An outstanding factor in the history of the industrialization of Brazil, the BNDES is also discussing the need and manner of inserting the environmental variable into the nation's industrial policy.

Recent assessments[26] of the effectiveness of the country's National Environment Policy identify as its main stumbling-blocks the limited availability of financial and human resources, as well as poor inter- and intra- governmental interfaces.

By law, Brazilian environmental agencies are assigned duties and responsibilities that require systematic attention at nationwide level. The effective performance of these functions consequently demands extensive equipment in terms of both staff and basic materials (transportation, laboratories etc.) that is both sophisticated and costly. The availability of funding to finance this structure satisfactorily fundamentally depends on budget allocations. This fact has proved problematic, as, in the situation marked by the financial crises in the government where environmental issues are not always tagged as top priority, environmental agencies have had to fight for funding with other budget segments.

The issue of the government's financial crisis has also set limits in obtaining foreign resources, a major source of financing. Public expenditure control policies have been hampering the Brazilian government to comply with requirements for local counterpart funding, which is normal in programs involving foreign financing.

Alternative sources of funding of a non-budgetary nature have proven insufficient. Only small amounts have been brought in by fines and penalties, as well as markets and control mechanisms. Other more expressive interests such as the royalties on oil production, mining and hydroelectric projects lack guarantees linking their use to environmental issues. The shaky integration between the agencies and branches of a single government – at both the federal and state level – has hampered the consideration of environmental constraints and standards within macro-economic or sectorial policies. Relations between central and state government agencies, although regulated by law, suffer similarly from difficulties with integration, which are particularly visible with regard to the transfer of funds and the definition of duties and responsibilities not clearly assigned by law. The question of inter- and intra-government integration in the final instance reveals difficulties of a political nature which should be handled through the implementation of an autonomous environmental policy.

26 Seroa da Motta (1991).

II.2. Importance of the environmental variable in industrial management

As seen previously, much of Brazil's water pollution is industrial in origin. With removal rates of 75% for organic loads and 60% for heavy metals, Brazilian industry still operates at water pollution levels higher than those noted in the developed nations. The industrial average for the organic load in 1988 was around g/US$ 18.2, higher than that estimated for US industry in 1972, of g/US$ 11.0, when the Clean Water Law in the USA had not yet been applied (Seroa da Motta 1993). This same trend is expected in emission levels for air pollutants whose removal rates are relatively low in Brazilian industry.

Due to its size and structure, Brazil's industrial sector presents an absolute volume of discharges into the atmosphere whose weight is appreciable within the total industrial emissions for Latin America as a whole. (See Table II.1).

Also due to its composition in terms of the intensity of use in natural resources, energy and water, for some pollutants, Brazilian industry chalks up average emission rates per US$ produced higher than those noted for Latin American industry as a whole (excluding Brazil) as shown in Table II.2.

Table II.1

Brazil and Latin America – Industrial Emissions (1992)

Pollutant	Latin America (A)	Brazil (B)	(B)/(A) (%)
Part.(ton)	2,074,211	848,691	40.91
SO_2 (ton)	142,084	41,891	29.48
NO_X (ton)	800,319	280,308	35.02
HC (ton)	114,838	46,127	40.16
CO (ton)	126,407	48,410	38.29
CO_2 (10(3) ton)	234,577	63,314	26.99

Source: Table prepared from data estimated by OLADE-SI.

Table II.2

Emission/US$ Produced – Industry (1992)
Comparison between Latin America[1] and Brazil

Pollutant	Relative Position
Part (ton)	Brazil 37.5% more than Latin America
SO_2	Latin 20.39% more than Brazil
NO_X	Brazil 13.26% more than Latin America
HC	Brazil 33.51% more than Latin America
CO	Brazil 26.68% more than Latin America
CO_2	Latin America 36.28% more than Brazil

(1) Latin America excluding Brazil.
Table prepared from data estimated by OLADE-SIEE.

Even with unfavorable positions in relation to the situations found in the developed countries, industrial pollution abatement has been increasing its importance both in the concern of government agencies (federal, state and municipal) as well as in terms of company management.

This is due to the relative success of the implementation of Brazil's National Environment Policy, and its normative effects on industrial activities, as well as to the rising awareness within companies of the importance of the environmental variable in defining their competitive edge.

Considering this last point, the results of a recent survey of 23 major Brazilian industrial groups operating in 34 industrial sectors carried out by Boucinhas and Campos in 1993 are of interest. Covering giant conglomerates (61% with revenues of over US$ 200 million) and with appreciable export activities (56.5% with over half their revenues from exports) this survey indicates that environmental issues are already taking on strategic importance in the corporate management of these groups. The principal reasons for this stance are, from the point of view of the companies interviewed, the need to improve relationships with the community, increase the visibility of the company in communications media, improve marketing, and respond to importer requirements.

Almost 80% of the firms interviewed revealed that they already had an environmental policy, and 74% stated that they had objective knowledge of their environmental liabilities. Knowing their environmental liabilities means, in this case, having knowledge of the environmental problems caused by their companies' operations. It indicates some kind of responsibility not necessarily deriving from the presence of legal pressures, but from the conscience that, over the medium term, such pressures will be more effective and that using a cleaner way of production will become over and over again a decisive element in the definition of their competitiveness. Over 90% had already carried out or were waiting to carry out an environmental audit within the next two years. This is a significant fact, as Brazilian legislation does not yet make this type of audit mandatory. The companies also showed an awareness of the need to anticipate restrictive trends in environmental legislation, both domestic and foreign. Among these companies, 17.4% stated that the environmental audit is prompted by the requirements of importer clients. The major benefits expected from these audits include an improvement in the corporate image (43.5%), differentiation compared to competitors (30.4%), fewer problems with environmental supervision agencies (26%) and an increase in foreign market shares (21.7%).

Another indicator of the increasing relevance that the environmental variable has been assuming in the activities of governments and corporate strategies may be noted in the pollution abatement support programs developed by the BNDES.

As the official incentive agency, the BNDES not only requires industrial projects submitted to comply with legal requirements, but also offers lines of credit to support pollution abatement programs developed by government agencies,[27] as well as projects rectifying environmental liabilities incurred by industries, in addition to environmental investments within new industrial projects. Table II.3 below shows the amount of environmental

[27] For example, the II Industrial Pollution Abatement Project developed by the São Paulo State government and Brazil's National Pollution Abatement Program, to be implemented nationwide.

expenditures[28] disbursed recently by the BNDES System, as well as the anticipation of environmental expenditures in the total outlays of the Bank. The BNDES Planning Superintendency believes that this participation should increase over the next ten years to up to 20% of total outlays (*Gazeta Mercantil*, 6 June 1994). Lines of credit for environmental protection offer financing with interest rates of 6.5% per year, lower than the average BNDES charges (9.4% per year) and well below market rates.

Table II.3

Environmental Disbursements under the BNDES System
Period – 1990/1993 – US$ million

Year	Total Disbursement (A)	Environmental Disbursement (B)	(B/A)
1990	2,789.0	202.5	7.3%
1991	3,100.0	192.8	6.2%
1992	3,337.0	217.0	6.5%
1993	3,402.0	206.0	6.1%

Source: BNDES.

The sectorial profile of environmental outlays under the BNDES System given in Table II.4 spotlights the importance that the control of environmental quality through environmental investments is assuming from the absolute viewpoint, as well as in proportion to total investments within the corporate strategies of some export industries whose activities are characterized by high potential pollution levels. The most important cases, according to the data, lie in the Pulp and Paper, Iron and Steel, Chemical and Petrochemicals Sectors. Added together, these sectors account for some 71% of the environmental investments made under the BNDES System in 1993.

28 The BNDES considers as environmental investments: investments in equipment and water and air pollution control systems (associated or not to modifications in productive processes); in equipment and control systems for an adequate collect; in treatment of industrial, agricultural and hospital residues; in the elaboration of studies on environmental impact for new projects; in environmental recovering of degraded areas (vegetal recovering, decontamination, etc); in health , work and factory safety programs; and in systems of monitoring environmental quality of the considered activity.

Table II.4

Support from the BNDES System for Environmental Conservation – 1993 (US$ 000)

SECTOR	Total investments (A)[1]	Total environ-mental investments (B)[2]	B/A	BNDES SYSTEM – ENVIRONMENTAL INVESTMENTS		
				Envl. Inv. (C)[3]	C/B[4]	% x each sector
1. Cattle-raising & Agri-business	35,230	670	1.9	360	53.73	0.13
2. Alcohol & Sugar Mills/Plants	2,951	2,951	100	2,213	74.99	0.80
3. Auto-spares	23,361	9,079	39	2,287	25.18	0.82
4. Food	3,150	150	4.7	75	50.00	0.02
5. Beverages	14,200	150	1.0	75	50.00	0.02
6. Energy	198,205	842	0.4	571	67.81	0.20
7. Pulp & Paper	370,083	130,016	35	42,635	32.79	15.43
8. Oil Products	24,134	24,134	100	8,070	33.43	2.92
9. Chemicals & Petrochemicals	62,565	44,758	71	30,733	68.66	11.12
10. Iron/Steel	727,696	184,175	25	123,296	66.94	44.63
11. Textiles	18,588	810	4.3	648	80.00	0.23
12. Transportation	671,525	15,819	2.3	1,730	10.93	0.62
13. Others[5]	28,611	18,691	-	63,525	-	22.99
14. Total	-	432,245	-	276,218	-	100.00

Source : BNDES
Notes:
(1) Sum of own and third party resources invested in the project by the entrepreneurs.
(2) Portion of the total investment assigned to environmental preservation and control.
(3) Environmental investment financed by the BNDES System (BNDES/FINAME).
(4) Participation of the sector in total environmental investments financed by the BNDES System.
(5) Includes support for pollution abatement programs developed by government agencies.

Although very important, the BNDES lines of credit have not been the only sources available to industry. Brazil's Pollution Abatement Program, financed by the World Bank, transferred US$ 34 million to industries in São Paulo between 1984 and 1987 (Phase I) followed by US$ 10 million from 1988 onwards (Seroa da Motta, 1993).

Other institutions such as the FINEP (Projects and Studies Financing Agency) of the Ministry of Science and Technology are also developing environmental control support programs. This institution is today the executive agency of the Multi-Lateral Fund – whose depository is the World Bank – set up to eliminate substances destroying the ozone layer discharged by industries in the developing countries. Under this program, various projects are being analyzed, principally in the refrigeration sector, needing financing of some US$ 15 million. FINEP has also earmarked funds for scientific and technological research in the environmental area. At the moment, US$ 20 million are budgeted for this purpose from the National Scientific and Technological Fund, which is dependent on transfers from Brazil's National Treasury (*Gazeta Mercantil,* 6 June 1994).

II.3. The iron and steel sector

II.3.1. Structural characteristics and competitive position

The Brazilian iron and steel industries generated revenues of some US$ 9.7 billion in 1992, ranking eighth among producers from all over the world. This same year, confirming the trend towards growth noted for over a decade, it accounted for 3.3% of worldwide production and 57.8% of Latin American output (see Table II.5).

The raw steel production industry embodies 33 companies with widely-varying technical configurations. Most of its output (69.6%) originates in coke-fired integrated companies. The distribution of companies by technical configuration may be seen in Table II.6.

Exports of iron and steel products rose rapidly during the 1980s to reach US$ 4.4 billion in 1992. Its participation in sectorial output reached appreciable levels measured both by quantities – over 50% as well as by revenues – approximately 35% [29] (see Table II.7).

Table II.5

Iron & Steel Industry – Brazil and Worldwide (10^6 t)

Raw Steel Output	70	80	85	90	91	92
World (A)	595.6	715.6	718.9	770.0	735.8	714.0
Latin America (B)	13.2	28.9	35.8	38.5	39.4	41.4
Brazil (C)	5.4	15.3	20.5	22.6	22.6	23.9
C/A (%)	0.9	2.1	2.9	2.7	3.1	3.3
C/B	40.9	52.9	57.3	53.5	57.4	57.8
Relative position - Brazil / World	18th	10th	7th	8th	8th	8th

Source : IISI/LAFA/IBS.

Table II.6

Brazilian Raw Steel Output – 1992

Technical Configuration	Number of companies	Output (10^3 t)	Share (%)
Integrated – coke	5	16,662	69.6
Integrated – charcoal	6	3,980	6.6
Integrated – direct reduction	2	472	2.0
Semi-integrated	20	2,820	11.8
Total	33	23,934	100

Source : IBS.

Table II.7

Participation of Exports in Total Revenues – Brazil – 1986-1992 – (%)

	1986	1987	1988	1989	1990	1991	1992
(%)	16.9	21.0	28.3	24.5	27.9	35.7	35.6

Source : IBS. Prepared by: FUNCEX.

29 This inconsistency is largely explained by the difference in domestic and foreign prices, favorable to the former, as well as the exports structure.

Similarly, throughout the 1980s, Brazilian exports rose in relative weight within worldwide iron and steel products exports from 5.4% in 1983 to 7.5% in 1990, maintaining a sizable proportion of total Brazilian exports – 10.29% in 1985, 11.92% in 1990 and 12.31% in 1992.

Between 1985 and 1992, foreign sales in this sector rose 14%. Over this period, the relative importance of the North American market declined considerably, while the European Union markets and Japan remained stable in their share of total iron and steel exports. In turn, the LAIA nations began to absorb a larger proportion of these exports. In absolute terms, the participation in the markets of the LAIA, European Union and Japan rose (see Table II.8 and II.9).

An analysis of the technological capacity of the Brazilian iron and steel industry reveals that, from the processes point of view, the production park operates with standards close to those in force internationally during the reduction phase (coke-rate, 1989: Brazil – 480; Japan – 464) as far as the steel-shop. Lags are encountered during the final stages of the processes: ladle metallurgy, ingot-casting (1991, continuous-process ingot-casting: Japan – 99.4%, South Korea 96.4%, USA 75.7%, Brazil 56%) and rolling mills. This technological lag during the final stages expresses to a large extent the structure of Brazil's iron and steel industry, intensive in basic and semi-finished products (see Table II.10) (Paula, 1993).

During the early 1990s, the privatization process was launched for state-owned steelmills which guaranteed the Brazilian State control over much of Brazil's domestic iron and steel production. This process increased the market power of two market groups (Gerdau and Villares), causing some economic agents to wonder if privatization would end up by replacing a public monopoly by a private oligopoly, which was to be expected at least for some of the less sophisticated production lines. As consequences which are already visible, this trend prompted an increase in the average productivity of the sector through an appreciable reduction in staff, with an end to constraints on the diversification of activities and the price controls regime, together with a financial clean-up and administrative reform (Paula 1993).

Table II.8

Brazil – Participation of Countries or Economic Zones in Iron & Steel Exports – 1985/92 (%)

Year	USA	CANADA	E.U.	LAIA	JAPAN	EFTA	OTHERS	Total
1985	18.8	1.2	7.8	7.5	7.9	0.4	56.1	100
1990	11.7	1.0	8.0	5.8	8.8	0.6	63.8	100
1992	10.8	0.7	8.1	11.6	6.5	0.7	61.1	100

Source: MICT/SECEX. Prepared by: FUNCEX.

Table II.9

Exports Growth Rate by Destination Market (%)

Period	USA	CANADA	E.U.	LAIA	JAPAN	Others	Total

1985/92	-0.4	-1.0	73.6	16.0	39.0	84.0	67.0

Source: MICT/SECEX. Prepared by: FUNCEX.

Table II.10

Brazilian Iron & Steel Products Exports – 1985/92 – (in US$ 1.000)

Economic zones	USA	CANADA	E.U.	LAIA	JAPAN	EFTA	OTHER	TOTAL
YEAR: 1985								
Pig-iron	13,349	1,016	35,043	338	16,741	3,952	197,280	267,719
Iron alloys	63,640	6,894	57,789	11,358	78,786	2,338	5,643	226,448
Semi-manf.iron&steel	129,597	7,233	70,457	14,564	38,018	0	141,739	401,608
Manfd.iron & steel	291,323	16,990	43,790	172,068	75,584	5,368	1,138,136	1,743,259
Total of sector	497,909	32,133	207,079	198,328	209,129	11,658	1,482,798	2,639,034
Overall Total	6,955,930	427,510	6.227,434	2,230,670	1,397,792	797,002	7,602,673	25,639,011
YEAR: 1 9 9 0								
Pig-iron	36,675	73	50,591	155	134,096	5,776	189,986	417,352
Iron Alloys	94,398	9,813	107,579	9,450	127,057	8,169	24,083	380,549
Semi-manf.iron&steel	156,694	8,921	63,755	18,173	57,867	85	447,555	753,050
Manfd.iron&steel	151,351	19,093	81,228	190,312	11,591	9,934	1,730,921	2,194,430
Total – sector	439,118	37,900	303,153	218,090	330,611	23,964	2,392,545	3,745,381
Overall Total	7,718,426	521,574	9,870,062	3,193,685	2,348,517	621,825	7,139,667	31,413,756
YEAR: 1 9 9 2								
Pig-iron	39,764	0	60,690	3,181	41,384	3,544	138,086	286,649
Iron Alloys	120,452	10,659	110,329	8,405	114,346	242	19,540	383,973
Semi-manf. iron&steel	180,996	9,335	90,153	26,435	20,432	0	628,247	955,598
Manfd.iron&steel	136,497	11,806	98,412	478,258	114,879	2,221	1,946,353	2,788,426
Total sector	477,709	31,800	359,584	516,279	291,041	6,007	2,732,226	4,414,646
Overall Total	6,933,230	401,495	10,627,516	7,591,924	2,306,067	436,661	7,564,632	35,861,525

Source: MICT/SECEX. Prepared by : FUNCEX.

Table II.11

Brazilian Iron & Steel Products Exports – 1985/1992 – (participation in list, in %)

YEAR : 1 9 8 5

Economic zones	E U A	CANADA	E.U.	LAIA	JAPAN	EFTA	OTHER	TOTAL
Pig-iron	0.19	0.24	0.56	0.02	1.20	0.50	2.59	1.04
Iron Alloys	0.91	1.61	0.93	0.51	5.64	0.29	0.07	0.88
Semi-manf.iron&steel	1.86	1.69	1.13	0.65	2.72	0.00	1.86	1.57
Manfd.iron & steel	4.19	3.97	0.70	7.71	5.41	0.67	14.97	6.80
Total – sector	7.16	7.52	3.33	8.89	14.96	1.46	19.50	10.29

YEAR : 1 9 9 0

Pig-iron	0.48	0.01	0.51	0.00	5.71	0.93	2.66	1.33
Iron Alloys	1.22	1.88	1.09	0.30	5.41	1.31	0.34	1.21

Semi-manf.iron&steel	2.03	1.71	0.65	0.57	2.46	0.01	6.27	2.40
Manfd.iron & steel	1.96	3.66	0.82	5.96	0.49	1.60	24.24	6.99
Total do sector	5.69	7.27	3.07	6.83	14.08	3.85	33.51	11.92

YEAR : 1 9 9 2

Economic zones	E U A	CANADA	E.U.	LAIA	JAPAN	EFTA	OTHER	TOTAL
Pig-iron	0.57	0.00	0.57	0.04	1.79	0.81	1.83	0.80
Iron Alloys	1.74	2.65	1.04	0.11	4.96	0.06	0.26	1.07
Semi-manf.iron&steel	2.61	2.33	0.85	0.35	0.89	0.00	8.31	2.66
Manfd.iron & steel	1.97	2.94	0.93	6.30	4.98	0.51	25.73	7.78
Total above sectors	6.89	7.92	3.38	6.80	12.62	1.38	36.12	12.31

Source: MICT/SECEX. Prepared by : FUNCEX.

The Brazilian iron and steel industry was not planned to export appreciable amounts of its production as is the case today. At the time it was set up, it was expected that some 10% of its output would be exported, a proportion that would ensure the balance of trade for the sector, a coal importer. The rapid growth of foreign sales was due to the shrinkage of the domestic market triggered by the economic crisis during the early 1980s, in parallel to increased production capacity which was, in turn, due to the maturation of massive investments made during the previous decade. In order to operate with continuous processing, this industry was forced to turn to the foreign market as a way out of its crisis, running counter to its original vocation. These circumstances characterize the export experiences of the Brazilian iron and steel industry, whose core characteristics were systematized in a recent study (Paula 1993):

- Exports as a strategy for survival, implying as a first step the sale of products at prices that simply cover only variable costs;
- The export drive coincides with a limiting international recessive situation, as well as an expansion of the iron and steel business, marked by a reappearance of protectionist strategies and;
- A keener competitive edge for less sophisticated products, resultant from the background of the implementation of Brazil's iron and steel industry, which fostered quantitative growth to the detriment of upgrading its product mix.

This last point highlights a characteristic of Brazil's iron and steel industry: its high concentration on the production of semi-finished products and less sophisticated goods with low added value, as may be seen in Table II.11. The product mix of Brazil's iron and steel industry is in turn reflected in the quality of its participation in the flows of international trade for iron and steel products. This market share is fairly appreciable for products with a lower added value, a situation which has reversed with regard to trade in high-grade steels (see Table II.12).

Table II.11

Product Mix – Brazil, Germany, Japan, France and South Korea - 1989

Products[1]	Brazil	Germany	Japan	France	S.Korea
Semi-finished goods	29.49	6.87	-	5.02	-
Bars & Sections	17.21	12.91	33.27	15.62	30.54
Heavy Slabs	11.88	11.32	9.55	7.63	12.48
Hot Coils	13.14	22.65	9.26	21.99	16.11
Cold Coils	11.58	14.20	13.18	15.25	13.06
Silicones	0.43	1.39	1.72	1.66	1.25
Galvanized	1.65	8.80	11.05	5.70	5.53
Tin-foil	2.41	3.30	1.82	1.66	1.25

Source : IISI, cited in Paula (1993).
Notes: (1) Arranged in decreasing value-added order. Note. : The data for Japan are from 1988.

Table II.12

Brazilian Participation in Worldwide Steel Exports by Product – 1983-1990 – (%)

Products[1]	1983	1984	1985	1986	1987	1988	1989	1990
Semi-finished goods	7.41	18.84	23.98	23.98	29.48	34.60	39.20	30.89
Rails/Accessories	0.02	0.01	0.06	0.01	-	-	-	-
Bars/Reinforcing bars	2.60	3.20	2.70	2.26	7.36	13.10	12.29	14.02
Sections	0.31	0.61	0.29	0.31	0.43	0.74	0.56	0.36
Wire-rod	4.47	4.01	7.63	6.08	6.09	11.70	7.99	9.90
Heavy Slabs	10.83	7.75	7.90	6.66	4.83	12.59	9.17	9.65
Hot Coils	8.86	7.69	6.37	5.41	4.44	8.21	6.48	8.29
Cold Coils	4.75	2.84	1.81	1.96	2.01	4.24	2.65	1.69
Tin-foil (2)	1.86	2.00	2.56	2.94	3.00	6.00	4.38	4.13
Galvanized	0.86	0.73	1.62	1.60	0.85	1.08	1.29	1.38
Pipes	1.02	2.56	1.61	1.65	1.14	2.15	2.36	2.37
Wires	3.00	3.88	2.79	2.62	2.19	3.91	3.41	3.33
Total	**5.24**	**5.58**	**6.05**	**5.31**	**5.59**	**9.03**	**8.81**	**7.59**

Source : IISI. IBS. Consider – Brazilian Iron & Steel Council (From Paula, 1993).
Notes: (1) Arranged in decreasing value-added order. (2) Includes chromed and high-carbon sheet steels.

In general, competition in the world's international iron and steel market is handled through quality or prices. Competition through quality requires industries to make heavy investments in research and development, boosting dynamism through technological innovations, with an emphasis on producing high-grade steels. In counterpart, competition through prices is primarily based on competitive advantages derived from low costs for labor[30] and raw materials (principally iron ore) and presupposes technological updating of production processes for commodity-type steels. This would be the way in

30 A sample of the ten biggest world manufacturers of cold coils (December 1991) reveals that wages paid in the Brazilian steel sector are 40% lower than those of Taiwan and South Korea and, in average, 70% lower than those of the other countries considered in the poll : United Kingdom, Australia, Japan, Canada, USA, Germany and France. On the other hand, this competitive advantage is compensated by the low productiveness of the Brazilian steel sector: in 1991, while in Brazil the production of 1 ton required 11 hours of work, in South Korea that number would be 6,7, and in Japan, 5,3 (Paula 1993).

which Brazil's steel industry best enters international trade (Paula, 1993). Endowed with these natural advantages, its principal disadvantages are high financial costs, as well as those for investments and transportation, dependence on foreign coal, remoteness from foreign consumer markets, and a low level of technological upgrading in the production of higher added value steels.

The good export performance of Brazil's iron and steel industry noted to date is based, as analyzed, on the competitive edge of low added value iron and steel products. This production makes intensive use of natural resources, using technology that is potentially polluting, due to the lack of heavy investments in liquid wastes control equipment. Added to this situation is the fact that some segments of Brazil's iron and steel industry use charcoal, which introduces the forest issue into the problems of this sector. An assessment of the situation of the effects of production activities in this sector on the environment reveals that this industry is not yet able to satisfactorily resolve an appreciable proportion of these problems – but it is at least aware of the nature and magnitude of these difficulties.

With regard to water pollution, the sector has achieved expressive reductions in organic loads (79% against a 75% average for industry). Potentially a low polluter under this item, it has a remaining pollution rate (pollutant load after abatement/GNP of the sector) that is appreciably lower than the national average (0.5 g/US$ against 18.2). The same may not be said for water pollution by heavy metals, where the abatement rate is noted to be close to the national average (58% against 60%) but with a remaining pollution rate far higher than the industrial average (1.3 g/US$ against 0.4). With regard to air pollution, the position of the sector within industry is not comfortable. Various air pollutants feature rates that are appreciably higher than industrial averages (Particles 111.40 against 41.34; SO_2 50.65 against 31.95; NO_x 17.21 against 13.88; HC 6.21 against 4.32; and CO 1214.93 against 151.39).

With regard to CO_2, Brazil's industrial emissions, due to the energy sources used, are lower than those found in the industrialized nations, arising essentially from deforestation. As the iron and steel sector is a consumer of charcoal (charcoal-fueled integrated mills and independent production of pig-iron), control of forest clearing becomes a major factor in environmental controls for this sector (Seroa da Motta, 1993). In the same way, the use of charcoal in the production processes of much of Brazil's iron and steel industry makes the sector a leading source of emissions of this pollutant.

The above considerations allow this sector to be characterized as potentially polluting, accounting for the remaining pollution rates that are still appreciable. The situation described may be overestimated as, on the one hand, the indices were calculated for 1988, and between this year and 1992, this sector made appreciable environmental investments of some US$ 400 million. On the other hand, in the industrial rating, the iron and steel sector, although appreciable, is a sub-element under the metallurgical sector, for which the indices were calculated. This is thus an industry which is potentially subject to foreign trade restrictions imposed under environmental protection criteria related to processes and production methods (PPMs). The following section attempts to analyze the views of companies on this issue.

II.3.2. The corporate view – Trade and the environment

In order to identify the views of iron and steel companies of the current or prospective impacts of foreign environmental regulations on their exports, FUNCEX sent out a questionnaire to almost all companies in this

sector. Thirteen firms, responsible for an appreciable proportion of Brazil's iron and steel production (50% of raw steel; 30% of ordinary flat-rolled products; 70% of common long-rolled products; 90% of commercial sheet-steels; and 80% of commercial slugs and bars) answered. The stock control of all of them is in private Brazilian hands, and over the past few years they have all maintained sizable export activities. In 1993, the value position of exports over revenues was between 20% and 30% for one company; between 40% and 50% for seven companies; between 60% and 70% for three companies; and over 80% for one company.

These companies state that they have not as yet faced obstacles of an environmental nature in their foreign trade. They also state that no segment of their exports has been subjected to environmental restrictions or rejected by importers due to ecological reasons. Only one among the thirteen companies sampled declared that it expects to be faced with problems of an environmental nature in the near future, meaning 30% to 50% of its exports could be subject to environmental restrictions. The principal foreign markets of this company lie in the European Union and USA (some 50% and 30% of exports respectively). All the other companies consulted did not export or earmarked a minor proportion of their exports (under 5%) to the European Union. In general, the same situation is repeated when the destination market is the USA (nine companies did not export and three others channeled 2.3%, 8.2% and 21% of total exports to the USA).

Only three companies were able to identify, even approximately, the average participation over the past few years of environmental investments in their overall investments (between 7% and 10%). They admitted that these investments had impacts (undeclared) over the short-term on their production costs, although to an extent insufficient to blunt their competitive edge in prices on the international market.

Information obtained from iron and steel companies through questionnaires and by interviews with technical experts in the sector (from companies and the business association – Brazilian Steel Institute – IBS) suggest that corporate actions designed to rectify the adverse effects of industrial activity on the environment have already been underway for a decade and cannot be explained directly by foreign environmental restrictions. In the near future, this variable could become more relevant, especially for companies whose exports are directed to markets in the European Union Nations, where more restricted actions are expected (demands for environmental certification, environmental countervailing duties, “eco-dumping” etc.).

The proportionally minor importance of the European markets in overall iron and steel exports is a factor that offsets the coercive power of foreign environmental demands on the definition of corporate environmental policies. In the same way, the current weight of foreign sales in Brazilian iron and steel industry business to a large extent is due to the flaccidity of the domestic market which has of late been dragged down by the economic crisis assailing the country. An turnabout in the economic situation will tend to boost the relative importance of domestic sales, producing a situation which could reduce still further the dependence of corporate environmental policies on demands and pressures imposed by importers.

Under these circumstances, the drive launched by the iron and steel sector to control pollution and solve environmental problems cannot, at the moment, in the view of technical experts in this sector, be

explained by relevant foreign trade restrictions. However, the companies state that they are aware that upgrading the industry to operate in accordance with internationally accepted standards should, over the medium term prove an important element in honing the competitiveness in the foreign market of Brazilian iron and steel products, above all when disputing markets in the developed countries in more sophisticated segments of iron and steel production.

Upgrading industry to operate in a manner compatible with worldwide standards means, from the viewpoint of the sector representatives, speeding up energy-saving programs, as well as pollution controls and maximizing re-cycling. They feel that Brazil's iron and steel industry is fully able to adjust to these standards; with regard to environmental protection, they state that the sector is in a strong position, having made appreciable investments to rectify its principal problems (air and water pollution, reforestation). Consideration of the environmental variable as a strategic factor in corporate actions in the iron and steel industry firmed up during the 1980s. This stance was due to multiple factors including:

- The development of domestic regulations (federal, state and municipal) covering environmental protection and control;
- Acknowledgment of environmental liabilities and the need to correct these in order to upgrade community relations; and
- Awareness that environmental issues are becoming increasingly important to society and that the development of a well-designed environmental policy can enhance the competitive performance of the company, through complying with legislation, guaranteeing good marketing and above all allowing optimum use of materials and energy over the medium term.

Environmental investments made by the iron and steel sector reached some US$ 400 million up to 1980. Between 1980 and 1992, over US$ 1,260 million were spent. Technical experts in this sector estimate that these investments rectified some 80% of environmental problems faced by the industry.[31]

Taking into account the technologies in use in Brazil, still from the point of view of these technical experts, it would be necessary to spend additional US$ 500 million in order to boost pollution abatement rates to their maximum possible limit of 94%.[32] Higher abatement rates would only be possible through radical alterations in the technologies currently in use.

31 This is an impressionist estimate, gathered during interviews. It suggests that the steel sector has been operating with a level of remaining (the actual discharge after treatment), water and air pollution of some 20%. Seroa da Motta's data presented in this study lead to the belief that the abatement rate of some 80% is over estimated.

32 These are still the sector's technicians' opinions obtained during interviews. The argument that the reduction of pollution due to the present technologies has a superior limit of 94% comes from the hypothesis that, beginning at a certain point, increasing reductions in pollution require increasing additional investments. Expenditures in pollution control would have, in this case, in terms of remaining pollution abatements, decreasing gains. By the given numbers, investments of US$1,660 million were capable of producing an abatement rate of 80%, at the same time that, to get additional 14%, US$500 million would be necessary. Present technologies would settle a rigid pattern in what refers to total pollution control, requiring expenditures incompatible with the plants' profitable operation.

Control of water pollution stands out as one of the principal environmental issues facing the iron and steel industry. Treatment of industrial water allows re-circulation to be increased, reducing the load of final liquid wastes which in turn must be treated in a subsystem that reduces the discharge of pollutants into water-courses. To do so, it is necessary to install various treatment systems within a steelmill (at the rolling-mill to reduce the level of oils and greases and neutralize acid waters; in blast-furnaces to eliminate particles; in the cooking plant to extract ammonia from liquid wastes etc.).

By 1992 the iron and steel sector had installed some 126 treatment systems designed to control water pollutants. It has improved the average indices for water re-circulation,[33] which reached 70% in 1993.

Improvement in water pollution indices by the iron and steel industries has nevertheless not eliminated major problems with water pollution concentrated in some companies. This is the case of the CSN steelmills which still accounts for 80% of industrial pollution discharged into the Paraíba do Sul River, the major source (90%) of water supplies for Rio de Janeiro State.

The massive environmental liabilities of the CSN steelmills are explained by various technical experts in this sector as being due to the fact that the company was state-controlled until 1993, when it was privatized. Due to the political nature of its administration, this endowed it with greater freedom from compliance with environmental legislation. Today, the CSN steelmill has a de-pollution project which is being negotiated with the Volta Redonda Town Council, for the area in which it is located, as well as environmental agencies and organizations, scheduling investments of some US$ 100 million. Of this total, US$ 58 million will be used in an Environmental Program designed to reimburse the town of Volta Redonda for the environmental damage caused by the operation of this plant over the past fifty years. This includes environmental control projects, cleaning up slums, and healthcare programs. Among other objectives, air pollution abatement programs are designed to reduce the discharge of benzene into the air. Benzene is a pollutant responsible for serious damage to the immunological system, very common among workers in the company (700 cases have been officially acknowledged).

Air pollution has absorbed a significant part of environmental investments made by Brazil's iron and steel sector.[34] Data available for 1992 reveal that 58.9% of these investments are earmarked for air pollution abatement, 26% for reforestation and 11.9% for water pollution abatement.

Another problem that the industry has been facing in this field and that is subject to legal standardization is control over steelworks dust discharge. Abatement means preventing the discharge of hazardous pollutants into the atmosphere, but in counterpart gives rise to the problem of disposal thereof. In São Paulo, studies are underway to form a consortium among the companies to build a steel dust treatment center, an option which is not feasible for a single company. The treatment of these wastes will allow the

33 Recirculated throughflow / total throughflow in circulation. In 1992 the intake (m3/h) was estimated at an average of 95,600, recirculation throughflow at 368, 000 and the total throughflow (recirculated + intake) at 464,100.

34 The principal environmental protection projects contracted and under way with BNDES financing are at USIMINAS (Brazil's first privatized steelmill) focused on air pollution abatement with total investments of US$ 130 million, of which US$ 84 million is financed by the Bank (Gazeta Mercantil. 6/6/94).

zinc to be concentrated and removed, resulting in the production of top-quality slag with a number of uses (pre-paving roadbeds for example).

Another critical point in relation to environmental controls is being faced by charcoal-fueled integrated steelmills. Current environmental legislation requires that all charcoal consumed must originate from non-native forests and be obtained through reforestation or management by 1998. This constraint has forced charcoal-consuming steelmills with the alternative of increasing investments in reforestation and/or reducing their demands for charcoal, converting their blast furnaces to coal.[35] Specialists in this sector believe that integrated steelmills will be able to comply with this legislation. In 1989, three major steelmills in Minas Gerais State reached self-sufficiency levels that were not negligible (ACESITA 55%, Belgo-Mineira 32%, and Mannesmann 32%).

Under pressure from both the law and society at large to intensify reforestation activities, companies have been led to invest in this field, while developing research projects designed to increase forest productivity and implementing methods of correcting possible environmental imbalances arising from the proliferation of eucalyptus plantations, the principal species grown. Reforestation indices are still insufficient to solve the problem of legal supplies of charcoal for the iron and steel industry. This is a serious matter, principally with regard to the independent pig-iron producing segment which is analyzed in the following section.

The Tables below show the development of the supply of charcoal by origin and consumption by iron and steel segment (integrated companies and independent pig-iron producers). Total consumption for 1992 (22,373 million m³) is almost the double of the supplies of charcoal from reforested areas (11,840 m³). This indicates that, despite the appreciable increase in supplies of charcoal from manmade forests during the 1980s, this is still not sufficient to cope with the requirements of the sector, if we include independent pig-iron production. Considered alone, the output of charcoal-fired integrated steelmills consumes less charcoal than total supplies of charcoal from reforested areas (some 60% in 1991 and 1992).

Table II.13

Charcoal Supplies (103m3)

Year	Origin – Native	Origin – Reforestation	Total
1983	18,423	4,087	22,510
1984	24,597	5,010	29,607
1985	26,085	5,501	31,586
1986	29,049	6,065	35,114
1987	27,725	6,624	34,349
1988	28,563	8,056	36,619
1989	31,900	12,903	44,803
1990	24,355	12,547	36,902
1991	17,876	13,102	30,978

35 The Belgo-Mineira steelmill has already converted its two main blast-furnaces to coal, and the ACESITA steelmill is sizing the investments needed for the plant to replace charcoal by coal (IBS – Informe Feb/94).

1992*	17,760	11,840	29,600

Source : ABRACAVE. (*) Preliminary data.

Table II.14

Charcoal – Consumption

Year	Iron & Steel Sector[1]		Estimated Consumption –
	Acquisition on Market	Consumption	Indep.Manufrs.[2]*
1983	6,616	8,629	9,324
1984	8,677	10,226	13,168
1985	9,126	10,095	14,474
1986	9,547	10,584	16,339
1987	9,842	10,935	15,180
1988	10,161	11,296	16,318
1989	10,750	11,694	18,308
1990	8,458	9,199	19,331
1991	6,797	7,799	16,488
1992	6,200	7,227	15,146

Source: SINDIFER.
Notes: (1) Refers to integrated companies producing steel and/or iron pipes.
(2) Refers to companies producing only pig-iron.
(*) The coefficient of 3.78 m^3/t of pig-iron produced was used.

From the viewpoint of specialists in this sector, the mandatory use of charcoal from manmade forests by integrated steelmills would exempt this segment from two major environmental problems. The first involves accusations over the effect of production activities on the destruction of native forests. The second, arising from the first, lies in the correction of the balance of CO_2 emissions, as the presence of a manmade forest base would to a large extent offset the discharges from the industrial processes.

Compared to industries in developed countries, Brazilian steelmills produce CO_2 emission levels that are relatively low, due to widespread use of hydroelectric power. This fact places them in a comfortable position with regard to trade barriers arising from possible international agreements over the control of global warming. If based on CO_2 emissions certificates (emission quotas for each country), it is difficult to see how domestic steelmills could suffer commercial constraints of this nature. However, with regard to non-mandatory environmental restrictions, there is a possibility of trade constraints arising from environmental requirements covering the production processes of each steelmill in particular.

In the case of coal or charcoal-fired steelmills, this could become a problem with regard to setting parameters covering the discharge of CO_2, a pollutant arising from production processes. The iron and steel segment that operates with charcoal argues that these parameters must necessarily take into consideration the presence of *planted* forest bases and that the charcoal in this production process is more than a source of energy: it is also a raw material. This latter circumstance means that changes in energy sources would only be possible through replacing the entire production process.

Integrated coal-fired steelmills would have the same problem (CO2 discharges from burning coal) with the disadvantage that they do not have forest bases, and thus offer a less favorable CO2 balance. Even here,

replacing the source of energy implies substituting the technological process route. In this situation, the sector is potentially more susceptible to non-mandatory environmental instruments based on unilaterally defined parameters and criteria. Another issue that has aroused concerns in this sector involves the implementation of domestic and foreign legislation covering the international scrap trade. The segment of the Brazilian iron and steel industries operating on the basis of scrap accounts for only some 10% of the total output of raw steel. Scrap imports represent a very small proportion of the steel industry consumption, and has been functioning as an adjustment mechanism of domestic supplies. (See Table II.15).

Table II.15

Iron & Steel Scrap (103 ton)

Year	Plant Generated Scrap	Acquisition on Market	Consumption	Imports	Exports
1983	2,667	2,894	5,567	-	-
1984	2,965	3,651	6,324	31	1
1985	3,629	3,423	6,998	104	-
1986	3,718	3,491	7,198	491	-
1987	4,013	3,213	7,319	138	1
1988	4,242	3,409	7,676	87	-
1989	4,654	3,417	8,032	342	-
1990	3,248	2,878	6,574	113	-
1991	3,155	2,545	5,714	89	3
1992	3,482	2,660	6,086	99	1

Source: IBS.

With regard to scrap supplies, two points are of concern to specialists in this sector. The first would constitute, over the medium and long term, a possible upsurge in Brazilian steel output based on steel, in step with international trends, visible principally in the USA. This scenario would involve an appreciable increase in the demand for scrap. Any restrictions on international trade in this product arising from domestic (CONAMA) and foreign (Basle convention) legislation under discussion could curb expansion of production through this technological method.

The second point, which is over the short-term, refers to expectations of minor growth – or even shrinkage – of domestic scrap supplies, due to increasing iron and steel exports and a drop in domestic per capita consumption (during the 1980s, this fell by 28%). Thus, even in the situation where scrap based semi-integrated steelmills merely maintain their share of domestic production, domestic shortages of this product are associated with restrictions of an environmental nature on international trade could cause serious problems to this segment of the industry. This gives rise to the importance attributed by the sector to discussions of standards which will regulate this trade.

Despite remaining pollution problems in the iron and steel sector, it is nevertheless certain that environmental issues have been incorporated into this sector's strategies. They appear in the concerns of the professional association (Brazilian Steel Institute – IBS) as a keystone of its work program, just as is the case in the strategies of major steel complexes which today have environmental divisions and clear-cut environmental policies. Even

government agencies responsible for environmental issues such as the State Environment Foundation – FEAM – in Minas Gerais acknowledge the efforts of companies that have been seeking to operate with good standards of environmental controls. An example of this is the policy of the Belgo-Mineira steelmills which, according to its Environment Manager, will over the short-term achieve a situation in this field that can guarantee the company environmental certification that its actions comply with internationally accepted standards. This is the outcome of sizable investments made in the past and scheduled for the near future. Between 1974 and 1993, the company spent US$ 84.7 million in environmental investments, and for the current year investments of some US$ 15.3 million are scheduled. It has already signed a Deed of Commitment with the State Environment Foundation – Minas Gerais that will require additional outlays of US$ 12.6 million between 1995 and 1997. These investments are basically earmarked for water and air pollution abatement systems, as well as increasing the re-circulation rate for industrial waters. These comments, based on information obtained through interviews and questionnaires, outline the general situation of awareness within the sector of the possible effects of foreign environmental constraints on export performance.

- The sector has not yet undergone restrictions of an environmental nature that could adversely affect its export performance. Other non-tariff mechanisms placing constraints on trade, such as voluntary exports restrictions, anti-dumping and countervailing duties have been the principal barriers to foreign trade faced by these companies.
- The sector expects an increase in environmental control requirements over the next few years, particularly in the European Union.
- Importance of the increasing stringency of these requirements is somewhat relative, as the European Union is not the major market for the Brazilian iron and steel industry as well as the fact that this sector will be in a position to operate in accordance with internationally accepted standards in a not too distant future.
- Regulations covering the international scrap trade may cause problems over the short-term for the operation of semi-integrated steelmills. Over the long-term, this may hamper the expansion of this segment.
- The fact that the European Union is not today the principal market for Brazilian iron and steel export prevents this sector from being keenly aware that non-mandatory instruments based on unilaterally-defined parameters may block the future expansion of exports.
- These requirements will become more important in markets for products with a higher level of sophistication, where the participation of Brazilian exports is minor.
- The sector feels that control of its environmental problems has already topped some 80% due to heavy investments over the past few years totaling US$ 1,560 million. Data supplied by the Brazilian Steel Institute advocates that between 1986 and 1992, the participation of environmental investments in total investments made by the iron and steel sector reached some 20%. With regard to the steelmills, some of them are certainly at a more advanced stage than others particularly in terms of the handling of their environmental problems.
- The sector feels that the foreign trade variable has had little importance to date as a determining factor in the strategy ruling environmental controls implemented by steelmills.

The maximum rate for environmental controls through technologies in use hovers around 94%. Reaching this limit still requires additional environmental investments[36] of some US$ 500 million. Abatement rates above this limit would require the implementation of new technologies which are inherently less polluting, consuming less energy and fundamentally based on recycling. Significant movements in this direction can not be expected over the short-term and may even be hampered by legal restrictions on the international scrap trade.

II.4. The independent pig-iron industry

II.4.1. Structural characteristics and competitive position

Approximately 32% of Brazil's production comes from charcoal-fueled steelmills. Of this total, 19% is produced by non-integrated steelmills producing only pig-iron (independent pig-iron plants) and the remaining 13% comes from charcoal-fueled integrated steelmills which in turn account for 17% of Brazil's total raw steel output (see Table II.16).

The independent pig-iron production sector consists of 78 small and medium-sized companies operating 145 blast-furnaces with an annual installed capacity of 7.5 million tons. In 1992, total revenues reached some US$ 490 million. The upsurge in independent pig-iron production in Brazil took place over two decades ago and is concentrated in Minas Gerais State (see Table II.17). It originated as an economic option to make good use of the cheap, abundant supplies of its principal raw materials: iron ore, and charcoal[37]. The production of charcoal at low prices during this period was due to the expansion of Brazil's agricultural frontiers in this region, which prompted intensive forest clearing in order to create grazing or crop lands. The installation of production units was also spurred by the absence of appreciable barriers to entry (relatively simple **technology and modest industrial investments**).

Table II.16

Total Pig-Iron Production in Brazil (tons)

Year	Charcoal		Coke	Total
	Integrated Plants	Independent pig-iron plants	Integrated Plants	
1983	2,386,785	2,466,725	8,091,011	12,944,521
1984	3,005,412	3,483,553	10,744,429	17,233,394
1985	2,999,640	3,840,256	12,131,550	18,971,446
1986	3,129,050	4,512,350	12,618,396	20,259,796
1987	2,815,140	4,406,401	13,714,441	20,935,982
1988	3,117,043	4,683,460	15,622,786	23,423,289
1989	3,610,707	6,092,127	15,747,436	25,450,270
1990	2,902,300	5,642,603	12,957,700	21,502,603
1991	2,867,427	4,533,792	15,465,212	22,866,431

Source: SINDIFER/IBS.

36 The definition of environmental investments follow, here, the same criteria adopted by BNDES – see note 28

37 The most recent installation of a pig-iron complex in Carajás , Amazonia, follows this same logic.

Table II.17

Independent Pig-Iron Production by State (tons)

State	1988	1989	1990	1991	1992
Minas Gerais	4,433,447	5,347,921	4,868,352	4,061,098	3,790,797
	91.14%	87.78%	86.27%	89.57%	86.49%
Espírito Santo	212,154	359,698	307,029	206,345	245,572
	4.36%	5.90%	5.44%	4.55%	5.60%
Pará/Maranhão	211,447	279,641	383,683	241,966	347,004
(Carajás)	4.34%	4.59%	6.79%	5.33%	7.91%
Others	7,045	104,867	83,539	24,383	-
	0.16%	1.73%	1.50%	0.55%	-

Source : SINDIFER.

Many of the plants installed had precarious corporate and economic structures and some of them operated intermittently, making good use of favorable market situations. The competitive advantage of this sector was fundamentally based on the easy availability of raw material and labor at low cost.

The crisis in the iron and steel products market during the 1980s and the specific problems faced by the charcoal-fueled iron and steel industry (restrictions on the use of charcoal from native forests) reduced the number of companies in operation in this sector. By 1990, the industry was already operating with an appreciable idle capacity (52 blast-furnaces shut down, as well as 30% of the total installations) a situation which grew worse over the subsequent years (Paula 1993).

The domestic crisis of the 1980s in Brazil consolidated the importance of the foreign market for independent production of pig-iron, as shown in Table II.18. In 1992, foreign sales reached US$ 282 million, some 57% of billings for this sector. Measured by quantity, during this year exports reached 55% of the total pig-iron marketed, with volumes rising by 41% between 1983 and 1991. These exports were earmarked for a wide variety of destinations, and over the past few years markets in the Southeast Asian nations have taken on a relatively large importance. Japan, Korea, Taiwan and China accounted for 64% and 60% of total foreign sales in 1990 and 1991, respectively. The weight of the European Union markets has remained stable at around 10% with more marked fluctuations noted in the North American market. (See Table II.19).

Table II.18

Pig-Iron – Brazil - Articipation of Foreign and Domestic Sales in Total Sales – 1983/91 (tons)

Year	Domestic Sales	Part. (%)	Exports	Part. (%)
1983	762,169	29.6	1,808,125	70.3
1984	1,032,773	29.3	2,484,394	70.7
1985	1,503,264	37.8	2,477,867	62.2
1986	2,229,307	48.8	2,368,453	51.2
1987	2,196,402	51.7	2,045,208	48.3
1988	2,480,832	49.4	2,532,704	50.6
1989	3,143,535	51.7	2,931,687	48.3
1990	2,237,153	39.8	3,382,928	60.2
1991	2,057,556	44.5	2,562,964	55.5
1992	2,021,686	45.5	2,414,642	54.5

Source : SINDIFER.

Table II.19

Brazilian Exports of Pig-Iron – Destination

1988	%	1989	%	1990	%	1991	%
USA	20.10	Japan	25.26	Japan	27.73	Taiwan	25.73
Taiwan	16.93	Taiwan	13.60	China	16.69	Japan	24.20
China	16.46	India	13.46	Taiwan	13.47	USA	12.42
Japan	13.01	Korea	11.31	E.U.	11.85	E.U.	10.70
Korea	12.11	E.U.	10.64	USA	9.09	Korea	7.69
E.U.	10.69	USA	8.89	Korea	6.98	Malaysia	3.88
Argentina	3.79	China	7.27	India	6.18	India	3.61
India	1.85	Turkey	4.01	Hungary	1.67	Iran	3.24
Iraq	1.62	Saudi Arabia	1.53	Turkey	1.47	China	2.62
East Germany	1.41	Australia	0.86	Yugoslavia	0.93	Turkey	2.74
Others	2.03	Others	3.00	Others	4.00	Others	3.27
Total	**100**		**100**		**100**		**100**

Source : SINDIFER/MICT/SECEX.

Still today the comparative advantages of this sector are due to the low cost of labor and principally of its basic input materials. Estimates available indicate that 70% of the total fabrication cost of pig-iron corresponds to the cost of the coal consumed, and 12% for the iron ore. The industry operates with low efficiency levels in the use of coal,[38] a circumstance due largely to the fact that these plants are not integrated, thus preventing recycling of blast-furnace gases at downstream production stages (Paula 1993).

These comments spotlight the importance of access to supplies of charcoal at low prices in the competitiveness of this sector. These supplies have been slowing down, due to the exhaustion of native

38 In 1985 the independent pig-iron sector has a specific coal consumption index (m3 of coal/ton of pig-iron) higher (3.35 m3/ton) than that for the integrated steelmills (2.56 m3/ton).

reserves close to production centers, boosting prices through pressures on transportation costs. However, the main problem faced by the charcoal-fueled iron and steel sector is related to forest clearing controls implemented through developments in environmental legislation on this matter, in force today. It requires that by 1998, all charcoal consumed shall originate from reforestation or sustained management of forests. Complying with domestic legislation is the major challenge facing this sector and is currently the focus of corporate concerns, as it threatens the survival of these companies. Implementing a forest base (upstream integration) appears to be the core objective of pig-iron producers, taking priority over other strategies which are also well-known to be desirable, such as downstream integration. In the same way, alternative environmental issues are also coming to the fore, and have not been resolved by this sector yet (abatement of water and air polluting discharges).

The following section summarizes the overview of these companies regarding the effects of environmental regulations on this sector and its export performance.

II.4.2. The Corporate View – Trade and the Environment

The following comments are based on interviews and questionnaires submitted by FUNCEX to the professional associations representing independent pig-iron producers and other companies in this sector.

The implementation of a forest base is the principal challenge faced today by Brazil's charcoal-fueled iron and steel industry. This issue is the direct outcome of legislation over the use of forest resources promulgated by Minas Gerais State at the beginning of the 1990s39. According to producers in the sector under analysis, the legal situation previously in existence was not able to effectively discipline the efficient use of these resources. The Minas Gerais State law was in turn the result of pressures from society at large as well as the government's acknowledgment of the adverse impacts of deforestation on the State, which today retains only a small proportion of its original forest cover (some 20%). As this has important effects on economic activities, this law was a result of intensive negotiation involving government agencies in the environmental area, civil environmental organizations and business sectors interested in these issues.

From the point of view of the iron and steel industry, this law was both desirable and necessary. It was the outcome of an internal consensus on its importance, setting clear-cut horizons for the sector to operate in compliance with internationally accepted environmental protection standards. It establishes reasonable deadlines, through its scheduling, for forest resource-consuming sectors to gradually phase in the consumption of input materials coming from reforestation projects or sustainable forest management, which should reach 100% by 1998. The sector's assessment of its environmental control program and its performance in international trade, as well as the role played by environmental pressures made by trading partners, may be summarized in the following points.

- The sector has not as yet suffered any restrictions of an environmental nature on its foreign business, which today represents an appreciable proportion of its operations.

39 In the case of the pig-iron production sector, Minas Gerais State law is decisive as most of Brazil's pig-iron production is concentrated in this State. Similar legislation is currently under official consideration in other Brazilian States.

- More intensive pressures are expected principally from the European Union.
- Adjustments in the environmental liabilities of this sector can not be explained by outside pressures and are all concentrated on forest issues and pressures exercised by the Minas Gerais State legislation.
- The industry's activities within the parameters laid down by law will place the sector in a comfortable position with regard to Brazilian society and external agents (national governments, environmental organizations, financing agencies and importers).
- The sector supports the forest law, having participated in its negotiation.
- The law is in step with fiscal incentive and financing schemes which help underwrite planted forests. It is backed by support programs such as PRO-FLORESTA as well as lines of financing from international organizations such as the World Bank. Relationships with this organization are confirmed by the effective handling of environmental problems under way in Minas Gerais State [40].
- Complying with the law (no consumption of charcoal from native forests), the pig-iron industry will feature advantages in relation to the coke-fueled iron and steel industry (better CO_2 balance, negligible sulfur production, and less slag produced per ton of pig-iron).
- The law encourages and offers incentives for the production of timber by small farmers (outsourcing). In addition to opening up new fields of economic activity within the State, this reduces problems arising from eucalyptus plantations (the principal species planted) over large areas.
- Environmental imbalances due to single crop plantations are technically controllable and can be reduced through reforestation programs.
- A larger proportion of charcoal coming from reforestation projects can upgrade the quality of the pig-iron produced.
- Legal requirements will block the survival of part of this industry. Difficulties in the sector as a whole in complying with legislation may be indicated by estimates that state that from 1991 onwards, in order to comply with the law, annual investments of US$ 1 billion will be necessary, against sector revenues of around US$ 0.5 billion (Paula 1993a). The disequilibrium between income and necessary investments shows that the latter will not be made in the required level, thus, due to environmental legislation requirements, part of the industry will not survive. In the opinion of specialists in this sector, a trend towards industrial concentration is not expected, as the costs of these mills are relatively small compared to the costs of the forest base necessary to operate them (US$ 1.00 against US$ 4.00). Buying mills would require enormous additional investments in forest projects, a situation which is not very probable, principally taking into consideration the current and expected behavior of the demand for this product.
- Some of the steelmills are already closing down, due to the shrinkage of the market and even advances in environmental legislation. In states other than Minas Gerais, companies consuming charcoal from native forests declared that areas of environmental protection have proved not to be feasible.

40 Forest laws are currently under official consideration in other pig-iron producing States.

- The sector believes that it has achieved a 50% coverage of its environmental problems of forest nature.
- Charcoal from reforestation products is more expensive than native charcoal. The price of native charcoal varies greatly, due to supply and demand, but has historically tended to rise, spurred by increasing transportation costs. At the time of the survey, the sector advised that the cost of charcoal reforestation projects was around US$ 25 per m^3 against US$ 19 to US$ 20 per m^3 for charcoal from native forests.
- Rising costs of charcoal, by substitution, should affect the production costs of pig-iron but not to an extent able to cancel out its competitive price advantages. This would also involve upgrading the quality of the product.
- Currently, due to the competition among domestic mills, companies that are not investing in forest bases are enjoying a temporary advantage with regard to costs formation. For some companies consulted, with investments in the forest areas, these investments are today around US$ 1.00 for each US$ 20.00 in billings.
- The environmental investment drive undertaken by these companies is today concentrated on reforestation (upstream integration).
- Investments in water and air pollution abatement lag further behind. However, they are the subject of an agreement with the State Environment Bureau, which includes the development of projects to be implemented during the next three years.
- By supporting the forest law, the sector believes that the issue of certificates of compliance therewith by the State Forest Institute will constitute the first step towards certification of environmentally-acceptable activities.
- Restrictions on forest clearing and CO_2 emissions would be resolved, from the sector's viewpoint, through compliance with the forest law. There is some wariness over the use of non-mandatory instruments for reasons identical to those put forward for the output of charcoal fueled steelmills.

These comments describe the situation of independent pig-iron producers in Minas Gerais. This is the State where reforestation activities are being most intensively encouraged. In Northern Brazil (Carajás), the reforestation drive is relatively limited and pig-iron production still represents an incentive to fell native forests (Paula 1993). This section is less important with regard to the sector as a whole, as most of this output is concentrated in Minas Gerais. Similarly, the crisis in pig-iron production has caused the Carajás complex to postpone expansion programs, as it is operating with an appreciable amount of idle capacity.

II.5. Pulp and paper

II.5.1. Structural characteristics & competitive position

Brazil's pulp and paper industry's sales reached US$5.1 billion in 1992, accounting for 1.2% of the nation's GNP for this year. In 1993, paper production reached 5.4 billion tons, while pulp accounted for

5.0 billion tons. Brazil thus moved up to the 13th place among international paper producers, ranking the 8th among pulp suppliers, corresponding respectively to approximately 2% and 3% of global production. Brazil's pulp and paper industry basically embodies three types of companies:

- Non-integrated companies that only produce pulp (market pulp) characterized by huge plants with high production scales;
- Integrated companies, which are verticalized, producing paper from their own raw material: this group also presents plants with high production capacities;[41]
- Non-integrated paper producing companies that form a more diversified and heterogeneous segment, consisting largely of medium and small companies which constitute the principal Brazilian consumers of market pulp or scraps – they are the recycled paper producers.[42]

Table II.20

Brazilian Pulp and Paper Industry (1000 tons)

Year	Production		Exports		Imports		Employment
	Paper	Pulp	Paper	Pulp	Paper	Pulp	Total
1970	1099	664	1	39	174	28	34227
1975	1688	1190	10	153	196	82	51586
1980	3362	2873	156	891	252	51	76325
1985	4021	3403	508	890	121	39	74672
1990	4716	3915	940	1113	n.a.	n.a.	81087
1991	4914	4347	1077	1384	372	149	78001
1992	4921	4871	1235	1643	282	112	74612
1993	5380	5034	1222	2018	n.a.	n.a.	n.a.

Source: ANFPC.

The installation of Brazil's industrial park took place under the aegis of the II National Development Program during the 1970s, spurred by powerful fiscal and credit incentives issued by the Government. A few requirements were made for the approval of projects, in terms of minimum scales and up-to-date technologies (with regard to energy consumption and pollution abatement), and in the case of pulp producing plants, production on the base of eucalyptus that generates exporting surpluses. These requirements shaped the current configuration of this sector, whose principal characteristics are set out in detail below:

1. This sector presents a large level of concentration: in 1992, the four largest paper mills accounted for 39% of Brazil's total output, while in the pulp sector these same four companies accounted for 57%. This concentration is associated with the characteristics of the production

41 Upstream integration of pulpmills confers sizable cost advantages through ownership of their own forest base. Pulp and paper integration reduces corporate vulnerability with regard to supplies of raw materials, while allowing various stages of the production process to be eliminated, thus trimming production costs.

42 A recent study (Jorge, 1993) states that of Brazil's 180 pulp and paper companies, 115 use recycled fibers.

process as well as the installation plans implemented during the 1970s and 1980s.[43] Furthermore, it allowed important gains in scale. The concentration in the integrated companies segment should become more accentuated over the years, due to the entry into operation of projects being developed by major companies. During the 1980s, smaller producers made no investments (Paula, 1993).

2. Brazilian producers of pulp and paper are in a good situation with regard to the technological updating of their processes. Due to the newness of the mills and keen competition in international markets, they have incorporated technical transformations in the sector with relative speed, which has taken place in order to:

   - Develop timber growing techniques, together with development and adaptation of species;
   - Encourage the production of high yield pastes;
   - Upgrade paper quality; and
   - Reduce the discharge of liquid waste and the level of chlorine in finished products.
   - For the sector as a whole, environmental concerns have to a large extent shaped corporate strategies, both with regard to technological changes, as well as those involving the organization of the company (marketing, for instance). It is worthwhile mentioning here the development of processes eliminating the use of chlorine (Elementary Chlorine Free processes – which replace chlorine gas by chlorine dioxide – and Total Chlorine Free processes), as well as the increasing enhancement of products based on recycled fibers. In the forests, technical progress is leading to increased productivity as well as the study of decreasing the environmental impact of large areas of single-species manmade forests.

3. The use and development of forest techniques based on eucalyptus constitutes an important source of comparative advantages for Brazil. This type of tree takes approximately seven years to reach maturity, while others species used by the competition may take twenty or thirty years. This makes Brazilian fiber some 45% cheaper than North American and Canadian fibers.[44]

4. There is a clear-cut specialization in Brazil with regard to specific types of paper, as may be seen in Table II.2.1. Following the logic of the II National Development Plan, an informal split was made between paper producers,[45] based on the various types of paper. The principal types of paper produced in Brazil are wrapping paper and printing and writing papers, with this latter sector having shown itself the most dynamic domestic sector at the beginning of this decade. Several major investments have been made with impressive impacts on the supply structure of

43 In addition to the investments made under Brazil's II National Development Plan, in 1987 the II National Pulp and Paper Plan was launched, with BNDES funding, in order to expand the installed capacity and modernize this industry.

44 It should be noted that eucalyptus pulp is suitable only for some types of paper. Known as short-fiber pulp, it is highly resistant, although the paper is of poorer quality for bleaching. Even so, the producers have been successful in extending the use of this type of fiber (see Soares (1990)), which has, in turn, expanded its use as a raw material, including traditional producers, such as Canada.

these types of paper. In the case of pulp, Brazilian production is concentrated on short-fiber pastes (74% of the country's production in 1992).

As may be seen through Table II.20, Brazil exports an appreciable proportion of its output: around 25% in the case of paper and 40% for pulp. It should be noted that these percentages have been increasing over the course of time. This fact is associated with the shrinkage of domestic consumption allied to rising production. This is, in fact, one of the sectors of the Brazilian economy that has shown to be most dynamic during the 1980s – paper production rose 60% between 1980 and 1993, while pulp increased by 75% over the same period.

Table II.21

Paper Production – 1992 (1000 tons)

	Production (1)	Imports (2)	M/P (2/1)	Exports (3)	X/P (3/1)
Total	**4920**	**282**	**5.73**	**1235**	**25.10**
Newsprint	237	173	73.00	33	13.92
Printing	1397	58	4.15	583	41.73
Packaging	2224	6	0.27	451	20.28
Toilet	442	11	2.49	28	6.33
Cards/Cardboards	502	7	1.39	94	18.73
Special	118	27	22.88	46	38.98

Source: ANFPC.

Table II.22

Brazilian Pulp and Paper Exports

Year	Pulp		Paper	
	(US$ 1,000)	(% x list)	(US$ 1,000)	(% x list)
1980	362703	1.80	155543	0.77
1985	273873	1.07	282124	1.10
1990	592052	1.88	613442	1.95
1991	578364	1.83	657471	2.08
1992	735273	2.05	708972	1.98
1993	711006	1.83	797403	2.06

Source: MICT/SECEX. Prepared by: FUNCEX.

The composition of Brazilian exports reflects the production structure described above. The country is principally an exporter of commodity type products, mainly wrapping paper and writing and printing papers (see Table II.21), and is ranked as the 9th exporter of cardboard packaging worldwide, standing 13th for writing and printing papers. Of the other types of papers, only sanitary and newsprint papers have a low export coefficient (export/production). In the case of the sanitary papers, production is channeled almost totally to domestic consumption, as the ratio between added value and weight is low. This characteristic means that producers with smaller-scale industrial plants are located close to

[45] Zayen (1986).

consumer markets. In the case of the newsprint papers, the zero import tariffs on this type of paper imposed by the law which assured freedom for the press, have prevented the installation of a significant production park, with "protection" for Brazilian production being restricted to the differential between the domestic tax burden and the cost of transportation for imports.[46] Recently, this lack of feasibility was accentuated by abundant supplies of this type of product on the international market. Special papers, with higher added value – including with regard to weight[47] – present a good export/production ratio (39% in 1992). However, in absolute terms, Brazil's participation in this market is still very limited, and a future strategy should focus on upgrading Brazilian exports, in order to produce higher value papers whose international market is less competitive. The difficulties barring entry to this segment are appreciable, due to small production scales and the costs involving with the technological dynamism of this segment.

Brazilian exports are basically concentrated in products with a lower added value, keeping pace with the trend of Brazil's exports as a whole. As these products compete on the international market through price, Brazil's export performance is relatively vulnerable to price variations as well as to alterations in the competitive conditions of world markets. It should be emphasized that paper imports are basically concentrated in newsprint[48] paper, and some types of specialty papers.

As Table II.23 shows, the OEDC nations represent important markets for Brazilian products. Over 87% of pulp exports are earmarked for these nations. The European Union is the major consumer of exports (45% of Brazil's sales) a trend which has been increasing over the years. Other major markets are the USA (29%) and Japan (14%). In the case of paper, the geographical distribution of Brazilian exports is somewhat different. During the 1990s, the LAIA nations firmed up as major buyers, and by 1992 accounted for 34% of Brazilian exports. The European Union remained a major market for Brazilian paper: 31% of total exports were earmarked for this region. The USA, which accounted for 10% of exports in 1985, dropped in importance to 1% in 1992. Thanks to rising European imports, an increased participation by the OEDC nations was noted in Brazilian exports. The development of the exports by destination should, however, be analyzed taking two aspects into consideration: first, losses are noted in relatively important markets such as Japan and the USA while, second, competition is heating up on the international market.

46 This aspect is valid for the other segments. With the lifting of restraints on exports, customs duties dropped appreciably – the average rate for importing paper fell from 26% in 1990 to 10%, and for pulp dropped from 5% in 1990 to zero in 1993. A recent study (Jorge, 1993), estimates this differential as nil.

47 This is an important aspect due to transportation costs.

48 Due to the law ensuring freedom of the Press, import taxes on this type of paper have always hovered close to zero.

Table II.23

Brazilian Exports by Destination (% total)

	USA	Canada	E.U.	LAIA	Japan	EFTA	Others
1985							
Pulp	26.23	0.11	38.02	9.04	17.79	0	8.82
Paper	10.54	0	13.89	14.72	0.15	0.09	60.62
1990							
Pulp	34.29	0.27	41.08	1.66	18.15	0	4.54
Paper	1.39	1.52	35.30	12.66	0.46	0.48	48.19
1992							
Pulp	28.52	0	45.2	2.45	13.54	0	10.29
Paper	1.19	0.18	30.93	33.99	0.07	0.18	33.45

Source: MICT/SECEX. Prepared by: FUNCEX.

The competitive position of Brazil in the international market is good. Its share of the global market is sizable, as shown in Table II.24. The availability and speed of replacement of primary forest materials, mastery of manmade forest management technologies, as well as short eucalyptus fiber pulp fabrication and environmental management, the supply of renewable sources of energy (hydroelectric power) at competitive costs, as well as production scales, constitute the principal comparative advantages of Brazil's pulp and paper sector. In the case of paper production, the existence of small producers causes these advantages not to be equally shared by all manufacturers – some of them cannot manage to comply with new quality requirements and standardization due to the use of more modern printing and crimping machinery (Mendonça, 1993).

The maintenance of the competitive edge of Brazilian products is, however, not assured. Brazilian producers are faced with certain difficulties which tend to reduce their cost differential, fundamentally with regard to infrastructure and financial management of the companies. On the other hand, the technological development of the developed nations, as well as the dissemination of the use of eucalyptus by various "new" producers, such as Chile, South Africa, Portugal and Spain, may help upgrade the cost structures of various Brazilian competitors.[49] Finally, the imposition of very stringent environmental standards and regulations, principally with regard to the mandatory nature of recycled fibers – is a point that will be studied in greater detail below, tending to reduce the cost advantages of Brazilian producers.

49 The production of equipment is highly concentrated and, due to the characteristics of the production process, this is responsible for much of the technological transformation in this sector.

Table II.24

Largest Worldwide Pulp and Paper Producers – 1992 – (100t)

	Paper					Pulp				
		Production	% world total	Apparent Consump-tion	CA/P (1)		Production	% world total	Apparent Consump-tion	CA/P (1)
1	**USA**	74,729	30,32	78,757	105.4	**USA**	59,282	36.13	57,293	96.6
2	**Japan**	28,322	11.49	28,318	100.0	**Canada**	22,841	13.92	14,392	63.0
3	**China**	17,251	7.00	19,464	112.8	**China**	11,985	7.31	12,588	105.0
4	**Canada**	16,594	6.73	5,317	32.0	**Japan**	11,200	6.83	14,306	127.7
5	**Germany**	12,930	5.25	15,646	121.0	**Sweden**	9,589	5.84	7,021	73.2
6	**Finland**	9,147	3.71	1,245	13.6	**Finland**	8,525	5.20	7,397	86.8
7	**Sweden**	8,378	3.40	1,742	20.8	**IEC**	6,800	4.14	n.a.	n.a.
8	**France**	7,697	3.12	9,092	118.1	**Brazil**	5,368	3.27	3,810	71.0
9	**IEC**	6,050	2.45	n.a.	n.a.	**France**	2,609	1.59	4,177	160.1
10	**Italy**	5,961	2.42	7,631	128.0	**S. Africa**	2,320	1.41	1,770	76.3
11	**S. Korea**	5,504	2.23	5,383	97.8	**Germany**	2,240	1.37	5,894	263.1
12	**UK**	5,128	2.08	9,568	186.6	**Norway**	2,009	1.22	1,537	76.5
13	**Brazil**	4,915	1.99	3,962	80.6	**Chile**	1,681	1.02	472	28.1
	Total	**246,507**	**100.00**	**245,617**	**-**	**Total**	**164,059**	**100.00**	**163,344**	**-**

Source: PPI. Prepared by: FUNCEX.
Notes: (1) Apparent Consumption = Production + Imports – Exports; indicates whether or not the country has a surplus in the sector.

This situation is made still more serious by the over-supply on the international market. Throughout almost the entire 1980s, the paper sector was faced with positive rising consumption rates and relatively attractive prices. Heavy investments were consequently made, boosting production. Consumption then began to drop off at the end of 1980s due to the recession in the developed nations, with reasonably negative impacts on prices.

This is an energy-intensive sector which accounts for almost 9% of the total energy consumed by industry. The principal sources of energy for the sector are electric power, lye and fuel-wood, with this first source accounting for 45% of electric power consumption in this sector. This has resulted from the trend noted over the past twenty years, that is similar to that of Brazilian industry as a whole, with a rising use of electric power – as mentioned previously, principally hydroelectric – and shrinking use of fuel oil. In the case of fuel-wood, it should be taken into consideration that much of this comes from manmade forests.

Table II.25

Pulp and Paper Energy Consumption – by Type (%)

	1975	1980	1985	1990	1992
Steam coal	3.8	1.6	2.9	2.5	1.9
Fuel wood	10.3	9	21.7	14.5	11.7
Lye	13.8	19.7	21.2	20.8	21.5
Fuel Oil	37.1	28.7	7.9	10.2	11
Electricity	34.3	40.3	42.9	43.4	45.2
Other	0.7	0.7	3.4	8.5	8.6

Source: Energy Matrix, Brazil.

Corporate concern over environmental controls is already appreciable in the pulp and paper segment. Major mills have already made investments in order to reduce the discharge of liquid waste and particulate emissions.

Thus, although the pulp and paper sector is listed among Brazil's industrial sectors with the highest remaining pollution rates (pollution load after abatement / GNP for the sector), its pollution abatement rates are equivalent to 71% of the total produced. Particulate emission abatement reaches 79%, against an average of 57% for Brazilian industry as a whole. Air pollution indicators for particles in the sector (28.2g/US$) are lower than the average for Brazilian industry (41.3g/US$).

Sulfur dioxide emission abatement as well as a reduction in the discharge of nitrogen oxides is incipient in Brazilian industry, as is the case with its pulp and paper sector, where abatement rates do not top 1% for the former and are nil for the rest. But it is unquestionable that, for a developing nation such as Brazil, pollution problems caused by the discharge of these elements are not comparable in either size nor real and potential consequences with those produced by industries in the OEDC nations (Seroa da Motta, 1993).

- For a sector such as the pulp and paper sector, which an appreciable proportion of process and product technology is incorporated into the equipment manufactured by a limited number of major global producers, the compliance with environmental criteria and requirements may prompt two effects:

  - First, the cost of adapting a productive system in compliance with these requirements may be extremely heavy. The investments necessary to underwrite the strategy of compliance with environmental criteria may undermine the competitive edge of exports already established on the international market;

  - Second, this may implicitly make compliance with environmental criteria conditional on the adoption of specific technological solutions embodied in equipment produced by the manufacturers mentioned, potentially generating skewed effects on trade flows and international investments.

Concerns of this type become particularly acute during a phase such as the current stage where the global market is characterized by surplus supplies and low prices.

II.5.2. The corporate vision – Trade and the environment

The comments that follow are the results of interviews and questionnaires completed by companies and professional associations in the sector.[50] They seek to reveal the view of Brazilian exporters of the role that foreign environmental regulations are playing or could play in the near future, of the capacity of companies to maintain the good export performance noted as from the past decade.

We first present a general overview of the principal concerns of the sector, as stated by professional associations. We now summarize the positions of the companies with regards to these points, together with the description of the efforts to control the adverse effects of productive activities on the environment. From the viewpoint of the professional associations consulted, two issues of an environmental nature appear today as the major problems affecting the sector: the use of forest resources and recycling requirements. A third point is added to these two, and involves air and water pollution abatement.

The upgrading of recycling as a criteria for the production of paper directly affects pulp producers as it encourages replacement of this product. In the same way, it affects paper producers in nations such as Brazil which, due to conditioning factors[51] inherent in domestic paper production, feature recycling rates lower than world averages. The increase in recycling requirements is the result of two trends noted in the environmental area.

The first involves the legislation adopted in Germany less than three years ago, which forces packaging manufacturers to consume secondary fibers – scraps and recycled materials. Along the same lines, a law has been established in Belgium that requires a high participation of secondary fibers (60%) in the production of imported papers. Given the difficulty of reaching these requirement levels, this legislation was later revoked.

The second trend is linked less to State regulations and more to alterations in paper products consumption habits, which are increasingly influenced by tropical rainforest protection drives undertaken by non-governmental organizations in the developed nations. According to Brazilian producers – exporters, the link between pulp and paper products and forest clearing and the devastation of native tropical rainforests – particularly for nations such as Brazil with the world's largest reserves of that type of forests – has been actively established by environmental NGOs, adversely affecting the exports of companies that invest in the administration of manmade, ecologically-sustainable forests.

The efficiency of these actions has produced the preference or greater acceptance of recycling as a social standard by the final consumer. The emergence of recycled paper as a positive norm in social conduct tends to produce commercial effects on the production of pulp, by reducing its market. For paper producers, this turns environmental requirements for the products (definition of standards controlling the effect of its consumption) into requirements covering the process. The pulp and paper sector, as it mainly exports intermediate products and believes that it is in a position to comply with product requirements, is less exposed to product barriers and more vulnerable to process barriers. This circumstance gives rise to

50 Brazilian Pulp Exporters Association – ABECEL – Associação Brasileira das Empresas Exportadoras de Celulose and National Pulp and Paper Manufacturers Association – ANFPC – Associação Nacional dos Fabricantes de Papel e Celulose.

51 The proportion of secondary fibers used reflects factors such as the size of Brazil, its land-ownership structure, the quality of its forest base, domestic paper consumption, the existence of an efficient collection system etc.

a major concern among exporters over rising requirements imposed by importers involving criteria linked to the production process, even in the case where initiatives to establish environmental standards are not mandatory as is the case with the ecolabelling and environmental certification schemes. The definition of criteria and parameters to underwrite these standards constitute a decisive process for the conservation of the competitive advantages for Brazilian industry. It is in the decision process of its formulation and implementation that exporters see opportunity for the discretionary use of environmental requirements.

In view of the above considerations, the impact of the introduction of non-mandatory environmental standards on Brazilian pulp and paper exports fundamentally depends on the environmental goals implicit in this legislation. The criteria adopted seek to foster increasing use of recycled materials and clean technology, while reducing waste throughout the production process. In order to qualify for an eco-label, a product should not have more than a stipulated amount of "load points" (penalties), "which are awarded on the basis of several parameters" (Jha & Zarilli, 1993).

According to the Brazilian Pulp Exporters Association – ABECEL, ecolabelling and environmental quality certification are important and must be implemented, accepted, used and respected by suppliers and consumers. However, to guarantee reliability in terms of being accepted and recognized, the systems of providing ecolabelling awards must be based on the following seven conceptual and strategic points: (i) the system must be open, clear and transparent; (ii) it must be based on sound technical and scientific information; (iii) the criteria must not be discriminatory against products, producers, countries and regions; (iv) the criteria must be selected on the life-cycle basis and they must be independent of each other; (v) the system should not establish limits to process creativeness and competitiveness inherent to each country and case; (vi) the system must consider all types of impacts on the environment and not only a segment of them; (vii) the system shall avoid assigning preference to some technologies instead of others.

These strategic points were made because Brazilian "producers/manufacturers of paper and pulp felt that the working group – consisting of six European Union member-countries chaired by Denmark – had developed the criteria keeping in mind solely the patterns of European production, and rewarding only environmental efforts made in Europe. No attention was paid to the fact that in non-E.U. countries, positive environmental results might be reached in ways different from those that represent a priority in Europe and that solutions that are appropriate in Europe may not be used in other regions". (Jha e Zarrilli, 1993). It is important to note that "Brazilian manufacturers/exporters have been unsuccessful in voicing their concern, since their proposal to participate, either directly (through the International Chamber of Commerce) in the discussions for the settling of criteria has been rejected" (Jha e Zarrilli, 1993).

According to ABECEL, the way in which load points are established would largely benefit European paper producers because the working group that set the criteria and parameters does not follow the conceptual and strategic points described above, especially the criteria concerning: the point system, consumption of renewable and non-renewable resources, waste generation, and atmospheric emissions.

Concerning the point system, the Brazilian producers'/exporters' position is that the system should be better balanced between recycled papers and virgin pulp produced in a sustainable manner. With regard

to renewable resources, there are two issues involving the criteria of sustainability and consumption. For ABECEL, "the Helsinki definition of sustainable forestry is too vague to be workable, since it is not based on measured parameters. As there is a consensus about the difficulties of defining sustainability in the wide range of applications (from natural forests to the fast-growing plantations), a grace-period must be assigned to establish the standards and the criteria for this. Sustainable forests to be accepted as such must follow the criteria which are valid for the types of forests and places where they are located. These measurable parameters should be agreed by a team of acknowledged international experts, representing various regions of the world, so that different local conditions are considered. Compliance with the standards should be verified and certified by neutral auditors and/or authorities".

Regarding the timber consumption parameter, the ABECEL position is "that if forests are sustainably managed, the timber criteria must define zero load point. The present criterion as proposed by DG.XI gives from 0.9 to 1.2 load points when a tissue mill uses 100% virgin pulp, even when the wood comes from a sustainably managed forest. This means that, no matter how hard and efficiently you work to guarantee sustainability and to provide a sound relationship between industrial production and nature, you will be penalized".

Brazilian manufacturers/exporters expressed their discontent with the fact that producers outside Europe would be charged with load points corresponding to the amount of SO2, AOX and CO2 emitted during pulp and paper production. As already noted by Jha and Zarrilli (1993), "a reduction of sulfur emissions (SO2) in Europe would alleviate the phenomenon of "acid rain" that affects some countries in Europe. A parallel reduction of these emissions in other geographical areas will be of no use to Europe (which will be too far way to benefit it). Countries outside Europe which must reduce their sulfur emissions in order to comply with the ecolabelling criteria (such as Brazil) will probably never experience a similar phenomenon".

The reduction of AO_X emission is a questionable criterion because it works by giving penalties just for one side of the environment damage. According to ABECEL "today, a first-class bleached kraft pulp mill with minimum environmental impact has, after secondary or tertiary level wastewater treatment, an AO_X specific load of about 0.3 kg/t. According to he latest DG XI proposal, this corresponds to 1.2 load points when 100% virgin pulp is used in a tissue mill. On the other hand, no points are due in this criterion to the use of fibers coming from a deinking plant without any type of wastewater treatment".

Even if the AO_X content is implemented as a criterion, the concern factor should be reduced and the limits kept higher. According to ABECEL, Canadian and French scientists "have proven that AO_X levels below 1.0 kg/t are acceptable and not harmful to the environment. Thus, there is no reason to have a hurdle at a limit below this".

Concerning the reduction of CO_2 emissions, the ABECEL position "is to have criteria factors independent of each other. Should CO_2 be adopted as a criterion, our opinion is that the overall balance should be evaluated. Then, the removal and immobilization of CO_2 by planted forests must generate credit points for companies planting their own forests for pulping. To be consistent, the ABECEL position is valid only if credits are also granted for the use of waste paper due to the question of solid waste reduction".

The way in which waste generation and waste paper is calculated and load points are attributed would also mainly benefit European companies. According to ABECEL "the DG.XI criterion favoring waste (or re-cycled) paper may unbalance the future supply of fibers to the paper industry. The balance between virgin fiber and waste paper is by far the must reasonable alternative, if based on technical, economical and social issues. Our opinion is that no credit is due for solid wastes reduction in case of recycling waste paper. Waste paper is a resource, a raw material for the industry just like timber. Used paper must be environmentally-friendly, collected, cleaned, stored, handled, denied and used again". Due to the fact that the use of recycled paper by European companies is higher than in Brazil, the former are allowed to subtract it from the amount of waste generated.

The waste generated in manufacturing industries, such as pulp and tissue mills, CTMP and deinking plants, have different hazard and toxicity levels. The ABECEL understanding is "that wastes should be considered under the Total Equivalent Waste Concept, by weighting differences in toxicity and hazardousness".

Having interviewed Brazilian exporters, Jha and Zarrilli (1993) assert that the criteria based on consumption of renewable and non-renewable resources would allot few points to European producers for the following reasons.

a) Waste paper is not counted in the calculations of renewable resources.

b) No distinction is made between timber from planted forests which are generally sustainably managed, and other kinds of wood.

c) The beneficial environmental and social effects of planted forests have not been considered.

d) The consumption of fossil fuels is calculated using the implicit assumption that all countries have an energy grid similar to that of Europe.

e) The definition of sustainable forest management was handed down by Denmark, instead of being elaborated in an international forum.

The comments put forward by Jha & Zarrilli (1993) largely cover the arguments of Brazilian pulp and paper exporters. Brazilian industry in these sectors has made heavy investments in environmental controls and depends crucially on exports to make these investments profitable. The definition of criteria and parameters that upgrade specific environmental management methods tends to generate discriminatory effects in terms of international trades, skewing trade flows and investments over the medium term.

As already stated previously, it is important to note that, in the case of pulp – an intermediary good which is an input material for paper production – the definition of criteria and parameters that foster the use of secondary fibers immediately means upgrading the value of a product competing with pulp, therefore encouraging the replacement of pulp by this product. In this case, and taking into account the sensitivity of consumers and the activism of environmental NGOs in the forest products area, the effects are immediately felt on the pulp market, with demand tending to drop, adversely affecting the competitiveness

of the export industry and over the medium term undermining modernization plans, including those in the area of environmental management.

Taking into account the weight of the European market in the destination of Brazilian pulp exports, it may easily be imagined that these impacts tend to be particularly strong in this case.

II.5.3. Corporate Experience

In the market pulp production sector, FUNCEX gathered information from a major company (with revenues of US$ 350 million in 1991, with US$ 455 million in 1992, and US$ 327 million in 1993) whose export experience and overview of the relationship between trade and the environment are relatively representative, given its participation in business in this sector. A major exporter of bleached eucalyptus pulp,[52] it accounted for 55% of total Brazilian exports in 1992. Its foreign sales have been rising in importance as a proportion of billings, reaching some 88% in 1993. The principal markets of destination are the USA (20%-25% of exports), the E.U. nations (30%-35%), and the Far Eastern nations. Specializing in production for export,[53] this company is extremely alert to foreign environmental regulations that could affect its performance.

Through its representatives, the Company declared that it had as yet had no part of its exports rejected due to environmental restrictions. It stated that it was anticipating, through an active environmental policy, the possible imposition of requirements of this type.

It therefore expects that in the near future up to 30% of its exports will be subject to these restrictions, especially those originating in the E.U. nations. As described in the previous section, the Company's greatest fear is concentrated in the definition of the criteria and parameters of non-mandatory instruments, such as eco-labels and environmental certification systems,[54] which will tend to be used in the market of destination of its exports.

In its drive to think ahead and cope with the trend towards foreign environmental restrictions, the Company has installed new industrial processes, with the support of the BNDES, as well as speeding up more stringent requirements in compliance with environmental standards in its raw material procurement policy. It has also invested heavily in environmental marketing in both Brazil and elsewhere worldwide. It states that these environmental investments have had effects of its costs that are not negligible but not to an extent sufficient to offset competitive advantages.

The Company believes that it is acting within strict environmental control standards and that its competitiveness will only be affected by foreign environmental standards should they be used deliberately as non-tariff barriers.

52 Bleached eucalyptus pulp is the principal export product of Brazil's pulp industry (market pulp segment), accounting for 94% of exports in this sector.

53 Brazilian pulp exports are concentrated in five companies (100% of exports).

Since it was set up, it has made heavy environmental investments of approximately US$ 208 million. Of this total, US$ 177 million were channeled to the industrial sector and US$ 31 million to the forest area. For this year, special investments are scheduled around US$ 8 million.

In the forest area, the Company owns 130,000 hectares of planted areas, as well as 56,000 hectares of native reserves. For each 2.4 hectares planted, one hectare is set aside as a preserved area, thus guaranteeing biodiversity in planted areas.

The Company supplies its requirements for pulp production from its own manmade forests or through purchase from independent producers. The Company supplies nine million seedlings annually to these independent producers, thus reducing local pressures to fell native forests, as this increases the supply of timber coming from planted forests.

Much of the Company's competitive advantages are derived from its highly productive forest base. It uses more productive genetic material, in the volume and quality of the timber, developed in its own R&D Centers. It operates with a reduced maturation period for trees with high levels of mechanization in forest operations. It also uses modern techniques to maintain the production capacity of planted areas.

The high productivity of the forest base in turn reduces the quantity of land necessary for planting.[55] The Company feels that by consuming only reforested timber and through control of the possible adverse effects of single-species plantations on biodiversity, it cannot be held responsible for environmental degradation due to the circumstance that its output is based on timber as its principal raw material.

With regard to the production process, although the Company still uses chlorine gas in the bleaching area, it is already prepared to produce, at customer request, ECF (Elementary Chlorine Free) pulp as well as TCF (Total Chlorine Free) pulp. Two other major export companies also believe they are fully prepared to produce ECF, while another is equipped to produce TCF.

Still in relation to industrial processes in use, the Company has made sizable investments in liquid wastes abatement. In this field, its operational standards fall under compliance with stringent international standards with internationally accepted discharge indexes for liquid wastes, its emission of sulfur compounds, emissions of solid particles and air quality. In these areas, its environmental standards may be extended to the other four major Brazilian pulp exporters (Jorge, 1993). In addition to striving to act in accordance with the concepts of sustainable development, the Company believes that it has achieved high quality processing, products and services, as witnessed by its international certification (ISO 9002).

Based on this situation, the Company states that it has prepared to cope with foreign environmental requirements in international trade. However, it is concerned over the definition of non-mandatory standardization criteria, imposed principally by E.U. nations, which pay no attention to the fact that other

54 The company expects that it will have to reply to the questions defined by the European Union Green Seal System, as well as the Forest Stewardship Council and Environmental Certification (BS7750, CEINAs etc ...).

55 The pulp and paper production sector as a whole has a reforested area of some 14.2 km2/000 (1992). This total covers only 0.34% of the States where the planted forests are located.

countries such as Brazil may have achieved positive environmental results by means different to those used in Europe. By working on the basis of criteria developed through the European experience with its own specific characteristics, this would configure the use of environmental arguments as a way of discriminating against specific trading partners. The Company's fear is that this circumstance may become clearly expressed in the arguments of the business association (ABECEL) described above.

With regard to the paper mills, analysis of the interviews and questionnaires revealed that in this segment some adjustments are already under way, explicable by the environmental requirements imposed by importers.

This fact may be noted in the experience of two leading companies[56] in the printing and writing paper segment, with appreciable export activities (export share of revenues between 30% and 50% over the past three years). Operating in an area where Brazilian industry has proven itself to be competitive,[57] these companies produce in an integrated manner, on solid forest basis, with major markets in the E.U. nations.

These two companies declare that between 10% and 30% of their exports are already subject to environmental restrictions, although part of these exports have been rejected due to environmental criteria.

They thus feel that they are able to respond to the requirements imposed by importers, and expect these demands to increase in the near future, principally from the E.U. nations.

The principal requirement involves the need to replace elementary chlorine in the production process as a bleaching agent for wood pulp. They handle this demand through heavy investments in the environmental area.[58] One of these companies declared that 10% of its scheduled investments were earmarked for environmental investments. The other stated that today 70% of its scheduled investments are accounted for by environmental requirements (alterations in the process, underway until mid-1995).[59]

Both companies state that these environmental investments will not affect their costs sufficiently to blunt their competitiveness through prices on the international market. A third major company (printing and writing paper) between 1985 and 1987 invested heavily in the reformulating of its entire process technology (US$ 104 million). These investments boosted environmental control and totally eliminated the use of chlorine gas for pulp bleaching.

Similarly to the factors noted in the market pulp segment, the companies interviewed, which primarily work with exports of printing and writing paper, fear the implementation of non-mandatory instruments to comply with unilaterally defined parameters and criteria that could constitute "process" barriers to trade. Still in the

56 The production and export of printing and writing paper is reasonably concentrated. In 1992 the four main companies, which accounted for 80% of output and 87% of exports.

57 Between 1990 and 1992, exports of printing and writing paper rose 61%.

58 Part of these environmental investments are due to the demands of Brazilian legislation regulating the discharge of pollutants into the air and water.

59 This project is backed by the BNDES.

paper industry, another relevant experience was noted in a large company specializing in the production and export of wrapping paper,[60] a segment in which Brazilian industry has shown itself to be competitive.[61]

The company in question produces on an integrated basis from its own forest base, and brings in an appreciable amount of its total sales from foreign sales (between 30% and 40% between 1991 and 1993). With major markets in the E.U. nations (some 40% of its exports), the company has been faced with demands of environmental nature, concentrated on requirements boosting the use of scraps in the product mix. Around 10% of its scheduled investments are in the environmental sphere, some prompted by Brazilian legislation on emission abatement. To date, the Company feels that it is able to overcome environmental obstacles incurred by exporters. It expects an increase in the stringency of environmental standards, revealing concerns identical to those found in pulp exporters as well as those exporting printing and writing paper (non-mandatory, unilaterally defined instruments).

Finally, a company which acts in an exclusive and diversified manner in the special paper segment replied to the questionnaire with regard to the weight of environmental obstacles in its exporting experience. This company is not integrated upstream with pulp production, and over the past three years some 10% of its revenues have come from exports. Its principal markets are the Latin American nations, where the company has never run into any type of environmental requirements. It therefore feels that the destination of foreign sales determines the relevance of environmental requirements in the company's business outsides Brazil. In this case, investments in environmental control implemented by the Company were not originated in importer requirements but are rather due to rules implemented by domestic legislation.

This analysis of the views of pulp and paper producing companies on the impacts of foreign environmental restrictions on their export performance, reveals various common points in the experiences of companies operating in various sectors (pulp, printing and writing paper, etc.), which are summarized below:

- Major pulp export companies feature good environmental control indicators, the result of heavy investments over the past few years;
- Major paper production and export companies feel they are relatively adequate with regard to internationally acceptable environmental control parameters;
- A substantial proportion of exports in this sector consists of intermediate products, low added value commodities whose competitive strategy is based on prices;
- An important proportion of environmental investments by these companies are explicable by advances in domestic environmental legislation;
- Export companies feel they are able to comply with importer requirements on products;

60 The production of packaging paper also features high rates of concentration. In 1992 four companies accounted for 54% of output and 87% of exports.

61 Between 1990 and 1992, exports rose 26%.

- Currently, the most visible foreign environmental requirements are related to the demand for the replacement of chlorine gas (use of raw materials and fabrication of chlorine free products), as well as demands for increased use of secondary fibers;
- The companies are most deeply concerned about the establishment of requirements covering processes through non-mandatory instruments. This type of mechanism – defined unilaterally and beyond the control of organizations regulating international trade – may threaten the competitiveness of Brazilian companies on the foreign market (see the arguments of the business associations described above).
- The issue of increased requirements regarding the use of recycled materials is important for the Brazilian pulp and paper industry and represents a potential threat to its competitiveness. Increasing the use of secondary fibers replaces the demand for pulp on both the domestic and foreign levels. In the case of integrated paper producers, they are forced to replace a raw material (pulp) which is more competitive in terms of cost, given the current operating conditions of these industries and the low development of paper collection and recycling in Brazil.
- The potential effects of foreign environmental regulations on the export performance of these companies, basically depends on the relative importance of their markets and destination. Companies with a large proportion of their exports channeled to the developed nations (especially those in the E.U.), are more susceptible to negative impacts on their competitiveness, due to foreign environmental regulations.

II.6. Iron ore mining and processing

Iron ore mining and processing activities in Brazil during 1991 accounted for 0.65% of the country's GNP. With an evident vocation for exports, around 75% of this output is channeled to the foreign market, a proportion which in some major companies may top 90% (Paula, 1993).

Brazil is the world's largest iron ore exporter, alongside Australia, its major competitor. The competitiveness of this sector is based on the excellent quality of Brazilian ore, as well as the operations of companies working on adequate scales with good quality and productivity programs[62], with their own efficient transportation infrastructure, as well as joint-ventures set up with European and Japanese companies, and an appropriate product mix featuring a large proportion of pellets, the product with the highest added value in this industry. Long term contracts and joint-ventures tend to have as much influence on the level of competition in this sector as prices.

This industry is highly concentrated in production and exports. Five major companies account for 90% of foreign sales based on 18 mines in a universe of some 125 mines in operation in Brazil. Brazil's largest mining company – Cia. Vale do Rio Doce (CVRD) – in 1990 accounted for some 67% of the country's total ore exports.

62 The five largest Brazilian companies have developed quality management programs and expect to obtain ISO 9000 certification by the end of this year.

Brazil holds a privileged position on the world iron ore and pellets market. In 1991, the country's share of total international ore sales was 30.4%, a proportion which reaches 29% if measured by quantities traded. The same year, Brazil accounted for 35% of world pellet exports. Iron ore exports in 1992 reached some US$ 2.3 billion, with the major markets of destination being the E.U. nations (45% of total exports) and Japan (22%).

Given the characteristics of the world iron ore market and the competitiveness of Brazilian output, the export performance of domestic companies has proven to be solidly based, offering stiff competition to foreign producers. This circumstance makes it worthwhile considering the role that requirements of an environmental nature could play in the foreign trade of this product.

Major export companies have developed extensive environmental conservation projects in response to the heavy environmental impacts of their activities. These projects have absorbed some 1.7% of their revenues, totaling around US$ 40 million annually (see Table II.26). Expenditures in environmental preservation privileged disposal and contention dams, reforestation, talus stabilization and mud collect.

Table II.26

Outlays on Environmental Control and Preservation Iron Ore – Brazil – 1988-1991

Year	Total Outlays (US$ million)	Outlays/Revenues (%)
1988	50.5	2.6
1989	31.7	1.3
1990	38.7	1.5
1991	42.0*	1.5

Source : Sinferbase. Note: *estimated.

The principal environmental problems faced by this sector may be summarized as follows:

a) Water pollution – mud pollution silting up watercourses downstream from mines, which is more important than pollution by chemical compounds;

b) Air pollution – pollution by particles, which is more important than that due to gases (emissions which are negligible in the activities of this sector);

c) Sound pollution – pollution due principally to explosions;

d) Recuperation of mined-out areas;

e) Forest devastation – of little importance even in big projects such as Carajás.

The environmental problems described above are relatively easy to solve. Brazil's five largest export companies already run environmental protection programs which reveal that the sector's companies have already effectively incorporated the issue of environmental damage control caused by their productive activity to their entrepreneurial strategies. These efforts are reflected in the environmental investments undertaken by these companies over the past few years. CVRD has invested US$ 200 million by 1989,

MBR spent US$ 40 million between 1975 and 1989, Samarco has been investing funding of some US$ 4 million a year, while Samitri and Ferteco have annual outlays of around US$ 3.5 million and US$ 5.0 million respectively.

Efforts to preserve the environment tend to boost pellet production, replacing the sintering process, which is inherently more polluting. (Paula, 1993).

Major Brazilian iron ore exporters enjoy a satisfactory position with regard to abatement levels of the adverse effects of mining activities on the environment. The high level of controls is basically due to pressures from local communities as well as advances in Brazilian environmental legislation.

This is an interesting case, where a sector with major export activities enjoying solid competitive advantages on the international market, and with a sizable proportion of exports earmarked for the E.U. nations, does not have its environmental control activities imposed under pressures from importers. Even there, environmental requirements affecting products are irrelevant. Any foreign requirement must be based on process controls whose pollutant effects are, in the case of major Brazilian companies under reasonable control. As in the case of pulp, only an increase in the use of scrap in iron and steel production would have an appreciable impact on the sector, through the replacement of raw materials. This would, however, demand an increase in the importance of electric-powered steel shops, and an across-the-board replacement of the technological steel-producing processes of importer nations. This is perhaps one of the reasons why requirements for iron and steel products based on recycled raw materials have not assumed much importance yet, even though this issue is taking on increasing significance in the pulp and paper sector.

III. Conclusions

Some characteristics of Brazilian exports have suggested that the implementation of international environmental standards, which may have a negative impact on the country's export performance. As noted in the first part of this study, the level of specialization of the Brazilian economy is basically explained through the comparative advantages obtained on the basis of intensive use of natural resources and energy. This means that as more intensive use is made of these factors, the better is its competitive performance in global markets. Another indicator of the vulnerability of Brazilian exports lies in the high level of pollutant discharges – both liquid and atmospheric. A sectorial comparison between potential pollution levels, pollution abatement rates and export performances shows that, among the most dynamic sectors are those which are the heaviest polluters, but also those with the highest abatement rates, which suggests that participation in international markets will tend to prompt increased care with environmental variables.

However, the restrictions imposed from outside the country are not always the main reason for a *more responsible* attitude with regards to the environment. Rising concern with the environmental variable is found in corporate strategies as well as government planning at various levels. A demonstration of this fact lies in the importance of national environmental legislation in the corporate environmental strategies

as was observed in the case of the *forest policy* established by Minas Gerais State, and its effects on steel and pig-iron producers. Another evidence of the importance of this variable lies in the rising volume of funding mobilized by public financing agencies (basically the BNDES) for this area, as well as the demand for this type of funding, including in the sectors studied here.

Another set of characteristics of Brazilian exports highlights the difficulties in adapting to conditions which are more stringent in ecological terms. A significant part of the products exported by Brazil – and fundamentally those sectors with the best export performance – may be graded as homogeneous products with high production scales, and minor possibilities of product differentiation, which compete on the international market through price. Thus, operating in markets where competition is very keen, the cost of adaptation to environmental requirements may be extremely high, with massive impacts on the nation's production structure. This means that:

- Restrictions will tend to blunt the comparative advantages of Brazilian industry by imposing technical standards and energy requirements that are incompatible with the availability of resources in the country;

- High production scales will tend to expand the among of investments required;

- Historically, conflicting relationships between the sector supplying input materials and those producing finished goods, which in a closed economy were administered by the Government, will tend to hamper respects for standards that include appraisals of raw and input materials. This means transferring upstream back along the production chain the information and requirements covering the criteria – principally when the adaptations required in order to comply therewith involve heavy investments for the input materials production sector. This seems a particularly difficult task for sectors producing finished goods, in contrast with the pulp-producing sector, which is verticalized back to forest plantations.

- Competition through prices in international markets in highly competitive segments where Brazilian producers are price-takers, makes the competitiveness of Brazilian exports relatively sensitive to measures which involve cost variations;

- Limited product differentiation capacity undermines strategies which allow the recovery of increased costs through price hikes; on the other hand, the domestic market is also not contributing to the recovery of environmental outlays, as Brazilian consumers are not very demanding. The absorption by the domestic market of these costs could contribute to lifting this burden on foreign sales.

The results of this study, based on an analysis of the "environmental composition" of Brazilian exports and the case-study of three export sectors, reveal which are the relevant variables at the corporate level for defining the intensity of the impact of foreign environmental standards on companies, and what type of standard represents the greatest threat to performance in the international market.

The variables affecting companies that assign a greater or lesser corporate exposure to the effects of foreign environmental regulations include:

- The size of the companies and the weight of exports in their output (smaller companies with lower exports incorporate environmental strategies to a lesser degree). It should also be emphasized that the impacts tend to be reasonably clearly differentiated even among producers within the same sector, due to the intra-sectorial heterogeneity with regard to these variables. These effects may be differentiated even within each company, depending on the product lines channeled to the foreign market or the domestic market. Within this situation, the positive external factors generated by exports for the domestic market are limited, as the incorporation of environmentally-acceptable conduct may take place only in part of the company's production area and/or the sector as a whole;

- The destination of exports in the company's sales;

- The competition pattern on the market – as mentioned previously, competition through price hampers the absorption of increased costs associated with the environment;

- Corporate structure – the more highly verticalized and integrated the company, the greater its capacity to control environmental variables throughout the production process.[63]

With regard to the type of restriction imposed (mandatory or not, covering the production process or the product), the vulnerability of Brazilian exports seems to be less when this involves standards affecting the finished product. Environmental restrictions that take into account assessment criteria of production methods and the use of input materials, tend to have a greater impact on Brazilian exports – which is associated with the composition of the country's exports where intermediate products weight heavily, as well as the fact that Brazilian producers are in a relatively comfortable position with regard to compliance with environmental standards covering finished products. As compulsory process barriers are difficult to apply, at least when involving global agreements, non-mandatory instruments such as ecolabellings are growing in importance.

The use of environmental regulations as a barrier in international trade, may in principle take place through process or product barriers. The former discriminate against production processes due to environmental impacts which are considered as adverse by importers. This includes restrictions on the exploitation of natural resources and pollution abatement. The difficulty of implementing this type of barrier lies in the fact that the standard of appropriation of natural resources and the definition of desirable environmental parameters is theoretically the result of sovereign decisions taken under national environmental policies. This gives rise to the difficulty in agreeing on pacts covering this matter in international trade regulation agencies.

63 Similarly, this seems to affect the level of integration between producers and their suppliers of raw and input materials.

Foreign intervention only becomes legitimate in the case that the emission of pollutants affects the national space of other countries or worsens ecological problems of a global nature. This is the case with the emission of gases causing global warming (CFC – which attacks the ozone layer, and CO_2, associated with the greenhouse effect), which have triggered negotiations targeting the signature of global pacts.[64]

In turn, product barriers cover the effects of consumption of merchandise. They may be unilaterally defined by importers on the basis of environmental standards considered adequate in their own countries (standards for packaging, content of toxic substances, etc.).

Other environmental restrictions that are gradually tending to take on increased importance on the international market are ecolabelling schemes, as well as recycling requirements.

Ecolabelling schemes constitute non-mandatory instruments which are, a priori, associated with ecological marketing. They may include environmental standards covering products and processes. By their nature they are non-mandatory, allowing greater flexibility in the unilateral definition of their parameters. This fact mean the possibility of strengthening process barriers, instituted outside multilateral negotiations.

Rules covering recycling are designed to limit the use of natural resources and reduce waste disposal costs. They may fall due on products (products and packaging free of toxic ingredients, able to lower collection costs and maximize re-use efficiency) as well as processes (requirements covering the use of recycled input materials). The sectorial analysis carried out in this study offers some evidence that corroborates these hypotheses, as set out below.

III.1. Pulp and paper

The market pulp industry as well as the paper producing segments which are more competitive at the international level (printing and writing paper and packaging paper) feature characteristics that make them potentially vulnerable to foreign environmental restrictions:

- They export an appreciable proportion of their output;
- A large proportion of exports is channeled to markets that are more strict with regard to environmental requirements (principally the E.U.); and
- They compete in international markets basically through prices.

Their advantages lie in the fact that they are integrated (from the forest base through to the finished product), which means they are in a better position to control environmental variables throughout the production process.

64 The replacement of CFC is regulated under the Montreal Pact, of which Brazil is a signatory. Global agreements on CO2 are under discussion in international forum.

Segments of the paper sector that do not enjoy these characteristics are less exposed to the effects of environmental regulations on their export performance. An example of this is a special paper producing company whose foreign sales play only a small role in its total revenues and whose principals markets are the Latin American countries. This company has never faced environmental requirements, a variable which is still today virtually negligible in its international market strategy.

The production of market pulp, similar to the output of the paper-producing sectors mentioned above (printing and writing paper and packaging paper), must cease to use chlorine, in order to comply with the principal requirement imposed on their output. This implies alterations in the production process, already implemented by some Brazilian companies in response to the demands of importer customers.

In this situation, the major problems in this sector are concentrated on the possibility of increasing demands for recycling, as well as pollution abatement within the production process.

The issue of recycling, regardless of the reasons behind its imposition by importers (high levels of consumer sensitivity regarding forest clearing, the social upgrading of methods and products based on recycled paper, with disposal problems in the developed nations, etc.), is particularly decisive for the market pulp production sector. This simply means removing market producers through replacement of input materials. In the case of Brazilian paper producers, the requirements for increased use of secondary fibers diminish its competitive potential, as this cancels out the advantages based on the industry's integration back to the forest base, which is highly productive in a social situation that has a virtually non-existent tradition of waste collection and recycling, either quantitatively or qualitatively.

Based on manmade forests, whose possible effects on biodiversity are under control, this sector cannot be penalized for the destruction of native Brazilian forests. Operations in accordance with suitable environmental standards as regards to forests, compatible with domestic forest legislation, has demanded heavy investments. Stricter recycling criteria favor specific technical and economic standards that may be environmentally incompatible and poorly-suited to the supplies of natural resources that constitute the origin of Brazil's comparative advantages. This is a case where requirements of an environmental nature may act as a non-tariff barrier.

With regard to the restrictions associated with the discharge of pollutants in production processes, the sector is basically concerned with the rising importance of non-mandatory instruments. They may contain unilaterally defined criteria and parameters, which are more difficult to control by international trade regulation organizations (see discussion on setting these parameters by ABECEL – Section II.5.2). Pollution abatement is included under process barriers which, as noted previously, are more difficult to implement, when compared to product barriers. Even though they may involve pollutants with evident effects at the global level, this sector is more wary of their inclusion in non-mandatory instruments than under global agreements. The emission of CO_2 is a good example of this issue. As Brazilian industry as a whole, given the nature of its energy base, operates with CO_2 discharge rates lower than those noted in the developed nations, international agreements based on emission certificates will present few difficulties to Brazilian companies. However, schemes such as ecolabellings shift the discussion from the

industry as a whole to within the sphere of influence of sectors and companies. In this case, it is crucial for companies to have access to discussions of the parameters on which these schemes will be based. Still with regard to CO_2, the pulp and paper sector argues that assessment of its emission rates should include the compensatory presence of manmade forest bases, a fact not taken into consideration, in principle, by the ecolabelling schemes under discussion.

These observations reveal that the pulp and paper sector is potentially vulnerable to foreign environmental regulations. However, the shift from a potential situation to a situation of effective trade constraints will fundamentally depend on the nature of the instruments used and the possibility of their intervening in productive processes through unilaterally defined parameters.

III.2. The iron and steel industry

Brazil's iron and steel industry was not set up with a view to the foreign market. However, the crisis on the domestic market during the 1980s has prompted appreciable growth in its export coefficient. In this trend, the participation of the North American market in total exports dropped, while these figures remained stable compared to the E.U. nation markets. These circumstances increased the level of vulnerability of this sector, in view of foreign environmental restrictions, but not to an extent comparable to the situation encountered by other sectors, such as market pulp. The characteristics defining the potential exposure of this sector to foreign environmental standards may be summarized as follows:

- The sector today exports a sizable percentage of its output, a situation which will probably not be maintained with Brazil's return to economic growth.
- The markets where environmental restrictions tend to be more stringent do not constitute the principal foreign markets of this sector;
- The sector competes on the foreign market basically through prices.

To date, this sector has not suffered restrictions of an environmental nature that affect its export performance, as the foreign trade variable plays a relatively minor role in determining the environmental strategy adopted by these companies. Product barriers will be difficult to apply to its merchandise, and under these circumstances, restrictions arising from production processes represent a greater potential threat to foreign business. Non-mandatory regulations that set requirements on industrial emissions abatement may cause problems for this sector. This once again brings up the question of CO_2. Similar to the pulp and paper sector, pollution abatement requirements are more feared under the aegis of ecolabelling schemes than under global agreements. For the charcoal-fueled iron and steel industry, abatement of emissions of this gas should be taken into account in the total balance of its production activities, which includes the presence of planted forest basis. Using current technology, coal and charcoal-fueled iron and steel production will find strict CO_2 abatement controls, a barrier difficult to overcome. Charcoal and coal are raw materials in the production process, which restrict the replacement of this highly polluting energy source used by the sector.

Another issue of an environmental nature faced by the charcoal-fueled iron and steel industry, as well as independent pig-iron producers, involved in the destruction of native forests. The implementation of strict domestic forest legislation seems to be resolving this problem over the medium term. This is a point where factors of foreign origin (the keen sensitivity of European consumers to forest clearing) seem to have played a relevant role in corporate environmental strategies.

A final issue associated with environmental matters that is of concern to the sector, involves the regulation of the international scrap trade. As noted previously, the drop in domestic consumption of iron and steel products, while reducing domestic output of scrap, may also prompt restrictions on the output of semi-integrated mills, should severe obstacles to trade in this product be imposed.

III.3. Iron ore

Brazil's iron ore sector is highly competitive on the international market. As much of its production is exported, with Europe constituting a major consumer market, this is a sector that is potentially susceptible to trade restrictions of an environmental nature. As discussed previously, the major mining companies have not had to cope with this type of issue, although at the same time they have been implementing across-the-board environmental control programs.

Similar to the previous cases, product barriers are not applicable to this sector. On the other hand, looking at its production process, pollution by gases and chemical compounds is not that relevant in mining activities. This is why even process barriers will be difficult to apply.

One issue that is of concern to this sector lies in increasingly stringent requirements on the use of scrap in iron and steel production. In contrast to woodpulp, criteria for increased use of recycled materials are not associated directly with forest clearing, in the case of mining operations. On the other hand, this would demand an increase in iron and steel output by electric-powered steel shops, as well as an across-the-board replacement of technologies in use in importer countries that produce steel from iron ore. This is an interesting case, as it suggests that foreign pressures of an environmental nature tend to avoid the importance they have assumed in other sectors, should their implementation demand radical adjustments also in the industries of the countries that imposed these pressures. This would be an indicator of the discretionary dimension found in some requirements imposed by importers, which are in principle justified by environmental reasoning.

These comments on Brazilian exports and on the sectors analyzed indicate that they are vulnerable to process barriers. In this situation, the consolidation of non-mandatory instruments – such as ecolabelling schemes – whose control by international trade regulation organizations is limited, and which take into consideration an analysis of the entire production cycle, could constitute an effective threat represented by the imposition of environmental standards. This means that the vulnerability of Brazil's list of exports rises in step with the dissemination of schemes that incorporate assessments of the various ways of use of raw materials and production methods. As mentioned previously, these assessments also implicitly favor specific environmental, technical and economic standards that may well be incompatible with the

characteristics and development stages of various countries, making place for the discretionary use of environmental barriers. This means that the definition of criteria and parameters is a potential source of discrimination, by devaluing environmentally compatible production methods that are at the same time compatible with endowments of natural resources and sources of energy, that constitute the origin of the comparative advantages of Brazil, through much of its output, including within the sectors analyzed here. A good example of this lies in the imposition of energy standards and the use of input materials imposed by European nations found in ecolabelling schemes that neutralize the comparative advantages of Brazilian industry.

Additionally, the application of trade restraints may have negative effects on the modernization of companies, should this discourage the introduction of changes in the environmental conduct of companies. As noted in Section I of this study, export sectors are among the most highly polluting, although they also feature the highest pollution abatement rates. Thus, depending on the content of regulations, on the timing of their application (and, consequently, on the timing for companies' adjustment), the transparency of the decision processes and the participation of export nations in these processes, the cost of adaptation may be too high, thus affecting the firms' exporting rentability and discouraging – instead of encouraging – investments which would induce the modernization of their environmental management.

Finally, it should be emphasized that, among the sectors studied, restrictions imposed by Brazilian environmental legislation seem, at times, to play a role as important as that assigned to foreign restrictions in the corporate environmental strategies. This in turn reinforces the importance of a geographical location of the production plants, as the enforcement capacity of environmental regulations varies from State to State in Brazil.

The reduction of the vulnerability of Brazilian exports to trade constraints of an environmental nature would basically involve:

- With regard to initiatives already implemented, including ecolabelling schemes, being put into practice in the E.U., the adoption of non-discriminatory criteria and parameters, as well as decision processes compatible with GATT regulations;
- In the development of international initiatives that would lead to the consensual preparation of guidelines for the formulation and implementation of national and supra-national environmental certification schemes, that would act as a basis for mutual acknowledgment of domestic schemes. This would, to a large extent, eliminate the possibilities of discrimination on the international markets;
- On the Brazilian side, this would involve the development of initiatives targeting:

    a) Strengthening the implementation and monitoring capacities of the National Environment Policy through upgrading environmental agencies, as well developing and/or fine-tuning mechanisms, especially economic factors in environmental policy;

b) Expanding the knowledge of export sectors of initiatives under way in other countries and their production processes which presupposes, among other factors, the systematic generation and preparation of technical information on the use of input and raw materials, as well as the manufacturing process of companies in this sector;

c) Encourage the organization of a Forum for discussion and negotiation among the sectors producing input materials and finished goods for export, seeking mechanisms for cooperation, as well as fostering the modernization of these sectors, while reducing vulnerabilities due to the specific characteristics of Brazil's production structure;

d) In-depth discussions over Brazilian environmental certification schemes, expanding corporate and government activities in this area, while avoiding institutional lack of coordination and wasted resources. Along the same lines, technical cooperation with countries that already have implemented ecolabelling schemes, seeking compatibility between the Brazilian scheme and these systems, which would increase domestic and foreign credibility of the Brazilian initiative, creating a basis for future mutual acknowledgment of national schemes;

e) Joint assessment by the Government and the private sector of initiatives under way in the E.U. nations, while demanding through diplomatic channels that these schemes should comply with the new GATT Technical Trade Barriers Code;

f) Expanding studies in order to ensure better knowledge of issues involved in international trade relations of the environment. The analysis carried out in this report suggest certain topics for further exploration, such as:

- The impact of specific environmental measures on Brazilian exports (this was the path followed in the study carried out by FUNCEX on ecolabelling (FUNCEX , 1994), presented as an alternative methodology to that selected in this work (see part I.7). It would also be worthwhile exploring the effects of global pacts on corporate strategies, as well as Government policies;

- Possible changes imposed by the trade liberalization process on the environmental strategies and performance of Brazilian industry;

- The influence of environmental requirements – both domestic and foreign – in the relationship between the suppliers of raw materials and the producers of finished goods, as the complications in this area are recognized;

In parallel with these studies, it would be worth increasing the knowledge about the conditions of sectors which compete with products imported from Brazil in countries where environmental regulations are originated, to identify the elements that motivate the rules. This is due to the fact that, as observed in the sectorial studies – more specifically, in the differential treatment given to recycling in the paper and steel industry -, the imposition of environmental restrictions seem to be related to the characteristics and strategies of the sectors where they are originated.

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