CERTIFICATION OF INDUSTRIAL FOREST PLANTATIONS: A VIEW OF PRODUCTION FORESTRY IN CHILE*

GONZALO PAREDES

Forest Management Institute, Universidad Austral of Chile
P. O. Box 567, Valdivia, Chile
gparedes@uach.cl

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ABSTRACT

Certification of environmental standards and the sustainable management of industrial plantations have increased rapidly in the last 5 years in Chile. During this period the industry association (CORMA), the Government Forest Research Institute (INFOR), and a technology transfer organisation (Fundación Chile) have led the development of national standards for certifying sustainable forest management, CERTFOR. This process has established in Chile "community accepted" criteria for local natural and plantation forests.

With different objectives, the main companies have adopted one or more of the standards — ISO 14.001, Forest Stewardship Council (FSC), and CERTFOR. However, it seems that sustainable forest management certification has been adopted by the already good performers and no price premium has been observed in the market.

Keywords: fast-growing forest plantations; environmental standards; forestry policy; sustainable forest management.

INTRODUCTION

The traditional concepts of "non-declining even-flow of timber" and "multiple-use forestry" have evolved into "sustainable forest management" (SFM). This seems to be like the old concepts but with formal participation, in the decision-making, of invited agents labelled "stakeholders" to monitor the timber production process.

In an evolving scenario, Chilean forestry has become a laboratory for policy analysis and development. Exposure to international forest products markets has

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made Chilean institutions aware of the requirements of the global economy and the trends of international forestry. Therefore sustainable forest management certification, originally intended to halt the exploitation of tropical forests and old-growth temperate forests, has found fertile grounds in Chilean plantation forest industries fearful of loosing their share in international markets, among other managerial reasons.

The next section describes the main global trends that have been shaping, and will continue to shape, Chilean forestry as well as that of other emerging forestry countries. The third section describes the main forestry and forest industry facts that explain the quick adoption of certification standards among the main companies.

The fourth section describes the process of sustainable forest management certification of plantation forests in Chile, the agencies involved, and the steps in the process. The final section analyses some of the policy challenges not solved by the certification system in Chile.

SHAPING THE FUTURE GLOBAL FORESTRY

As in many parts of the world, Chilean native forests were for centuries treated as non-renewable resources in that they were either destroyed by fire to open land for agriculture and livestock, or "mined" by loggers who kept moving on to exploit the next "deposit".

By the end of the nineteenth century, the coal-mining industry, worried about a shortage of mine poles, imported seeds of forest trees from the West Coast of the United States and from Australia as the local natural forests had become scarce and distant. Those seeds brought to the country species that outperformed the local ones in terms of site productivity. In less than a century the new species, mainly *Pinus radiata* D.Don and eucalypts, not only satisfied domestic requirements for wood products, but also supplied a modern and diversified industry that currently accounts for more than 12% of the country's total exports (INFOR 2005a). The next section expands on the production facts.

With an economy open to international markets for the last three decades, the forest sector has been receptive to technological innovations and, at the same time, society has been sensitive to environmental concerns.

What explains the evolution of Chilean forestry, and what will its future be? The answers can be found by analysing the main technological forces driving world forestry (Sedjo 1997). The three main forces have been: the evolution of harvest technologies, developments in silviculture and bio-technologies, and the environmental standards now required in forestry production. A brief description of each of them will help to explain the combined effect they have had, and will continue to have, on Chilean forestry.

The developments in harvesting technologies observed over the last three decades were motivated by the increasing difficulties in accessing natural forests. When used in the more distant and inaccessible natural forests, these technical developments were able only to maintain traditional harvest costs (per cubic metre). However, when the technology became adapted to homogeneous forests in plantations, the cost savings became significant (Sedjo 1997). The new technologies have been adopted at the planning and operational levels in Chilean plantation forestry, thus increasing its competitiveness.

Other important innovations have occurred in the areas of establishment techniques, genetics, and associated biotechnologies. The combined outcome can be characterised, literally, as "building a second floor to the old house" (the land) and explained by the larger volume per unit of time and area, plus the fact that final products can be almost "customised" through silviculture of the growing trees. Plantation forests are increasingly homogeneous at harvest age and better suited to the end products, thus reducing the production cost per unit of final product. The adoption of these innovations has been promoted in Chilean plantation forestry for almost three decades, stimulated by the Genetic and Breeding Cooperative, a consortium of Government agencies, private companies, and Universidad Austral started in 1976.

The third innovation in forestry has been the environmental standards now demanded in any forest production activity. Either through Government rules or market-oriented certification schemes, these standards have a higher impact, on a cost per cubic metre basis, when implemented in natural forests than in "crop-forestry". The reaction in Chile to the new public demands is reflected in several recent restrictive regulations on production from native forests, and their strong enforcement.

Theoretically, the combined effect of these three forces should create, under constant industrial timber demand, an increase of timber supply from plantation forests while the supply share from natural forests decreases (Fig. 1).

In Fig. 1 the curves S_N and S_{NC} are the marginal cost of logs from non-certified native forests and from certified native forests, respectively; S_P and S_{PC} are the marginal cost of logs from non-certified plantations and from certified plantations, respectively.

The higher marginal cost in native timber production (from S_N to S_{NC}) is explained mainly by the increase in accessibility costs and the new environmental standards required through both regulations and certification protocols. At the same time, over the recent decade the impact of innovative genetics, establishment techniques, and harvest technologies on plantation forestry has more than offset the costs of certification standards; thus the supply curve for timber from plantation forests decreases from S_P to S_{PC}, as illustrated above.

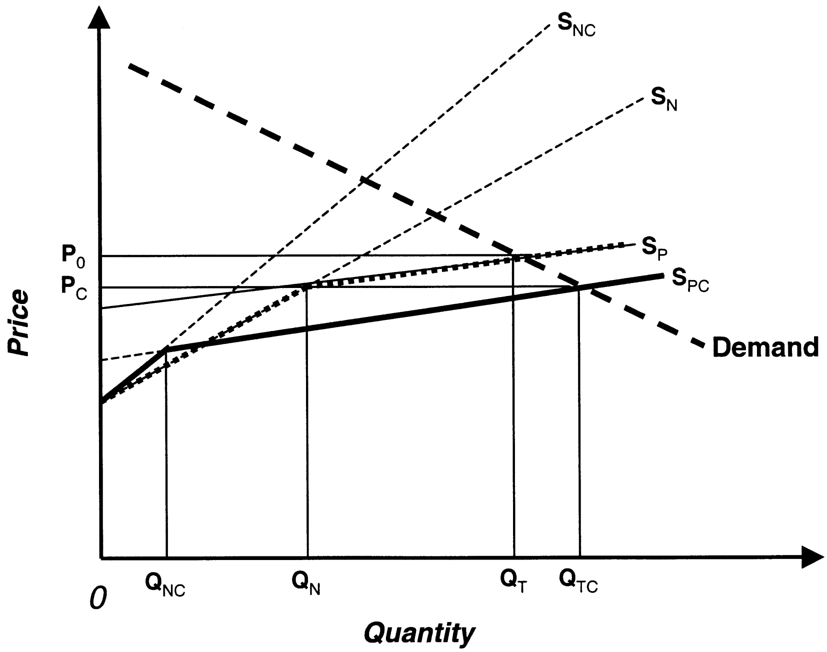

FIG. 1–Industrial timber supply evolution in Chile, last decades and trend.

The combined impact of these innovations is a decrease in the share of native timber supply (from Q_N to Q_{NC}) and an increase in the supply from plantation forests from $Q_T - Q_N$ to $Q_{TC} - Q_{NC}$. At the same time, given the resulting marginal cost (supply) curve, there is an increase in the total industrial timber supply from Q_{TC} to Q_T and a decrease in timber price from P_0 to P_C. As discussed in the following section, these trends have been verified in Chilean forestry over the last decade.

This industrial timber supply scenario is repeated in several other countries known as "emerging" forest countries, currently complementing the traditional categories of "tropical" and "temperate" forest countries. Their impact on the future world timber supply has been analysed by Sedjo & Lyon (1990), among others. These studies conclude that the "emerging" countries are the only ones able to satisfy the increased industrial timber demand. Besides Chile, the "emerging" forest countries are New Zealand, Australia, Venezuela, Brazil, South Africa, Argentina, Portugal, Uruguay, and others that are quickly incorporating capital and technologies to establish fast-growing forests.

CHILEAN FORESTRY

Forests cover 21% of Chilean continental land. This is an area of 15.6 million ha, including 2 million ha of plantation forests (72% with *P. radiata* and 20% with

Eucalyptus spp.), currently supplying 98% of the 32 million m^3 consumed by the forest industry in 2004 (INFOR 2005a).

While the log volume consumption of the industry has increased 50% in the last decade, the role of native timber has clearly been declining during the last decades, and the supply from plantation forests continues to increase (Table 1).

TABLE 1–Forest industry log supply, by species (thousand m^3/year)

Year	Plantation forests			Native forest	Total
	Pinus radiata	*Eucalyptus* spp.	Other species		
1994	16 006	1930	151	3315	21 402
1995	18 548	2214	152	3967	24 881
1996	17 995	1799	126	3017	22 937
1997	18 369	2025	164	3049	23 607
1998	16 409	2368	126	2412	21 315
1999	17 739	3306	180	1953	23 178
2000	18 806	3987	167	1476	24 436
2001	20 385	3975	181	1141	25 682
2002	20 188	4389	161	753	25 491
2003	22 088	4596	162	646	27 492
2004	25 802	5341	231	624	31 998

The observed decline in the industrial supply of logs from native forests can be explained by looking at the behaviour of the main type of logs: pulp logs of native hardwood species for the chip export markets — which had a production peak of 3 million m^3 in year 1995 — were gradually replaced by logs from *Eucalyptus* spp. plantations and vanished in 2002. On the other hand, the sawtimber and the plywood industries had adapted to replace logs of native species with logs from managed plantations of *P. radiata*: the industrial supply from native forests decreased from a production level of over 3 million m^3 in the early 1990s to 0.6 million m^3 in 2004 (INFOR 2005a).

One of the factors that contributed to diminish the competitiveness of native forests has been the stricter set of regulations on forest logging imposed by CONAF (the Chilean national forest service) since the late 1990s, as well as greater difficulties in accessing these forests (Álvarez 2003; Fresard 2004).

The analysis described in Fig.1 matches the observed behaviour of the industrial timber supply in Chile. In a decade the industrial supply from native forests decreased to a low 2%, while the volume supply from plantation forests increased 73% during that period to become 98% of total.

Despite their large area (13.4 million ha) native forests have limited potential for economic timber production. The area includes 3.9 million ha in the State-owned Protected Wildland System which comprises mainly over-represented forest types of the South and does not provide adequate conservation to native forests in the more accessible Central Chile. The area also includes 4.4 million ha of "protection forests" characterised by their slope, soil fragility, altitude, or closeness to streams. The rest of the area has limited accessibility and, often, a standing volume composition (large proportion of firewood and pulpwood with limited markets and a reduced volume of sawlogs) that is not economically attractive (Fresard 2004). These facts explain the current annual harvest level at only 624 000 m^3 in 2004.

Given the increasing supply of timber from plantation forests relative to the domestic market, the industry has evolved to become export-oriented in the last three decades. At the same time, higher transport costs to the target markets — in the Northern Hemisphere — and a decreasing cost of capital have allowed investment in new industrial capacity for processing the logs into value-added products. Therefore, current industrial consumption of logs is concentrated in the pulp and paper mills, sawmills, millwork and boards industries, with 89% of total industrial consumption (Table 2).

TABLE 2–Industrial consumption, 1994 and 2004 (thousand m^3)

Industry	1994	2004
Pulp & paper	7 219	11 212
Chips	3 897	2 698
Sawmill & millwork	7 163	15 510
Boards	897	1 814
Export logs	1 842	274
Poles & boxes	382	491
Total	21 401	31 998

In terms of value, exports of forest products originally included a large proportion of low-value products (logs and chips) evolving to more value-added products in the year 2004 (Table 3) (INFOR 2005b).

It is notable that millwork exports have increased nine-fold while log exports have almost vanished. Chip exports are currently only from *Eucalyptus* spp. plantation forests but in the past they were mainly from native forests (*Nothofagus* spp.).

Export destinations have remained essentially diversified; however, the value of exports to the North American region (United States and Mexico) has grown significantly compared to other areas. This region accounts for more than half the increase in value of the total exports in the last decade (Table 4).

TABLE 3–Forest products exports, 1994 and 2004 (million US dollars)

Product	1994	2004
Pulp & paper	795	1330
Board & veneer	82	239
Millwork	100	907
Sawtimber	158	335
Chips	164	137
Logs	114	12
Others	151	436
Total	1564	3396

TABLE 4–Forest exports, by region. 1994 and 2004 (million US dollars)

Region	1994	2004
North & Central America	199	1329
Asia	771	1014
Europe	311	594
South America	260	410
Oceania & Africa	23	50
Total	1564	3397

Looking forward, the recent timber supply studies on *Eucalyptus* spp. and *P. radiata* suggest that there is room for further expansion of industrial production and exports based upon these species. The *Eucalyptus* spp. supply can grow from 5.3 to 14 million m^3 by the year 2015 (INFOR 2002) and the *P. radiata* supply from 25.8 to 38 million m^3 by the year 2030 (INFOR 2005c). The main challenge will be the appropriate industrial processing of the logs included in the new supply: sawlogs from managed *Eucalyptus nitens* (Deane & Maiden) Maiden plantations as well as a large volume of pruned logs from *P. radiata* plantations.

CERTIFICATION OF CHILEAN FOREST PLANTATIONS

By the early 1990s, Chilean public opinion faced the controversial issues of conservation status of native forests and their rate of conversion to plantation forests. Environmental groups were quite active while the industry was either silent or just reactive, and Government agencies were slow to provide accurate information. These issues coincided with global concerns on the conservation of tropical forests and on the harvest of old-growth forests.

Most of the controversy was caused, at that time, by the absence of precise official information on the status of native forests. The pressure was eased somewhat when the Government agencies published the results of two important studies: the National Survey of Native Vegetation (CONAF-CONAMA 1999) and a compendium of official records on the utilisation and substitution of native forests (CONAF 1996). The Land Use Survey demonstrated that the total area covered by native forests (13.4 million ha) was more than the area calculated by environmentalist activists. At the same time, the data on native forest use (CONAF 1996) showed that for the period 1985–94 conversion to plantation forests had been no higher than 8% of annual planting, which was less than the 10 to 20% estimated by Lara & Veblen (1993).

It also became clear that native forest conversion to plantation forests was not always a direct process, since wildfires and clearing for agriculture had often happened before tree planting (Meneses 1999).

The institutional scenario also played an important role in providing a fertile ground for sustainable forest management certification. As characterised by Sedjo *et al.* (1998) the Chilean legal, economic, and institutional environment was, at that time, "moderately developed" while its institutional capacity to implement the objectives of the national policy was classified as "medium". These are the basic indicators under criterion 7 of the set of criteria adopted in the Santiago Declaration of the Montreal Process for the sustainable management of temperate forests. The other "temperate forest" countries included in the comparative survey were Canada, United States, Finland, England, France, Sweden, Germany, and New Zealand. For all of them the classifications in the study were "developed" and "high", for the respective indicators.

With this institutional performance, the local industry quickly understood that the certification processes were good and viable options. The question was: which one? As it became obvious that export markets will, sooner than later, request some sort of "certificate", some companies reacted by adopting the ISO 14.001 standard in the late 1990s and the year 2000.

At the same time, the Government research agency (INFOR), a technology transfer non-Governmental organisation (Fundación Chile), the industry association (CORMA), and other non-Governmental and Government agencies endorsed an effort to establish a national standard for sustainable forest management certification, CERFOR-Chile. The purpose was to develop a standard that would recognise the particularities of Chilean forestry, environment, and society, aiming for recognition by the Pan European Forest Certification system (now Program for the Endorsement of Forest Certification Schemes, PEFC). Geisse (2004) described the aspects of Chilean forestry that explain the political acceptance and institutional endorsement of the development of a national standard. Dube *et al.* (2004) provided a complete description of CERTFOR and the certification of a large Chilean company.

The options were the ISO 14.001, the Forest Stewardship Council, and the CERTFOR-Chile. A comparison by Cerda & Lira (2001) of the programs

CERTFOR-Chile and the Forest Stewardship Council described the main differences as being their positions with respect to genetically modified organisms (GMO) and a slightly greater emphasis on the welfare of forest workers by CERTFOR-Chile, rather than on local communities as seems to be the emphasis of the Forest Stewardship Council.

The performance, in terms of certified area, of each system (CERTFOR unpubl. data) is indicated in Fig. 2.

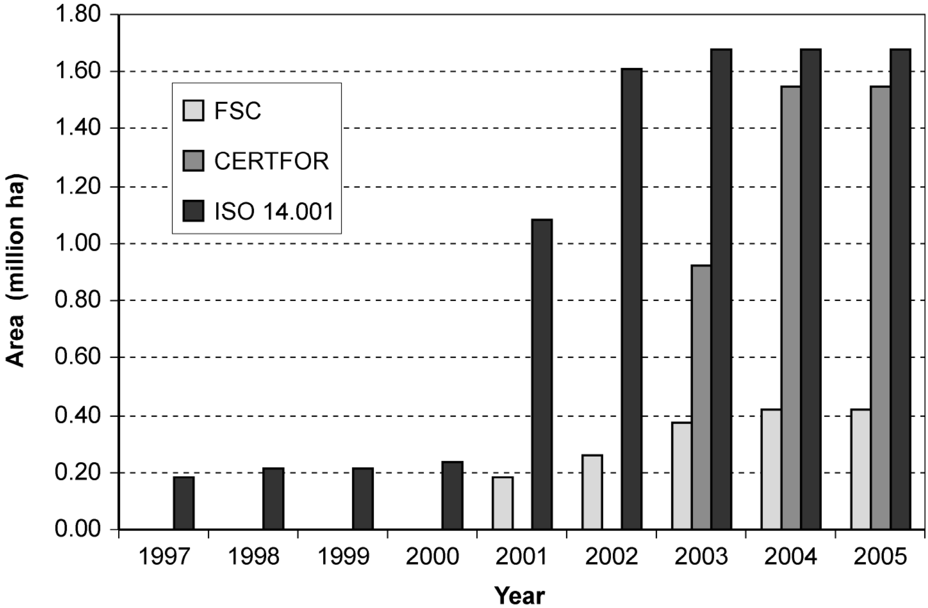

FIG. 2–Evolution of forest area certified (plantations and/or natural forests) under different standards.

While the issue of forest certification was coming to the fore, the companies adopted ISO 14.001. Some of them later adopted the Forest Stewardship Council standard, but as soon as the CERTFOR standard was developed in 2002 the companies adopted it as their sustainable forest management standard. Its recognition by PEFC in 2004 reinforced its adoption.

The current area certified is summarised in Table 5 (CERTFOR unpubl. data).

About two-thirds of the total plantation area is currently certified under sustainable forest management standards — 73% of *P. radiata* plantations and 61% of *Eucalyptus* spp. plantations. All the main companies have adopted at least one standard (as shown in the Appendix) and some medium-sized owners are in the process of certification.

TABLE 5–Certified area by standard in 2004

Standard/norm	Certified total area (ha)	Certified plantations (ha)
ISO 14.001	1 663 403	1 149 862
FSC	424 321	306 948
CERTFOR	1 552 420	1 079 612
Total (non-overlapped)	1 948 227	1 374 537

Certification of productive native forests is quite small and most of the certified area is in conservation forests owned by large companies.

The industry is already implementing, on the supply side, a chain of custody schemes with independent forest owners. At the same time, vertically integrated companies have adopted ISO 14.001 for their mill production operations.

The main outcomes, as declared by chief executives to the author, have been a net gain in deeper knowledge of all production processes in each company, and a better relationship with local communities and with direct and indirect labour resources. Higher production costs were, in general, mitigated by efficiency gains. On the market side, no one claims to have got a price premium, thus confirming the hypothesis of Sedjo & Swallow (2002) who stated that, for a voluntary system, if demand for certified wood is relatively small, if the costs of certification are not significant to some producers, and if the marginal increase of new demand is modest, then the market may not generate a price premium even if there is a large number of consumers willing to pay a premium. These seem to have been the conditions in Chilean forestry.

In the absence of price premium, the certified producers in Chile recognise greater loyalty in their relationships with clients.

DISCUSSION

The scenario under which the certification of plantation forests developed in Chile during the last decade has been briefly described. The rapid adoption was made by an industry already performing with adequate standards and, moreover, with a management capacity to undertake the protocols required by the labelling agencies.

Certification has served to improve the performance of already "good performers", but failed to improve the management standard of those forest owners that were the original target (Fig. 3).

The impact of eco-labelling of sustainable forest management certification is illustrated in Fig. 3. If we classify the forest production area according to a performance index of sustainable forest management, we get a distribution that

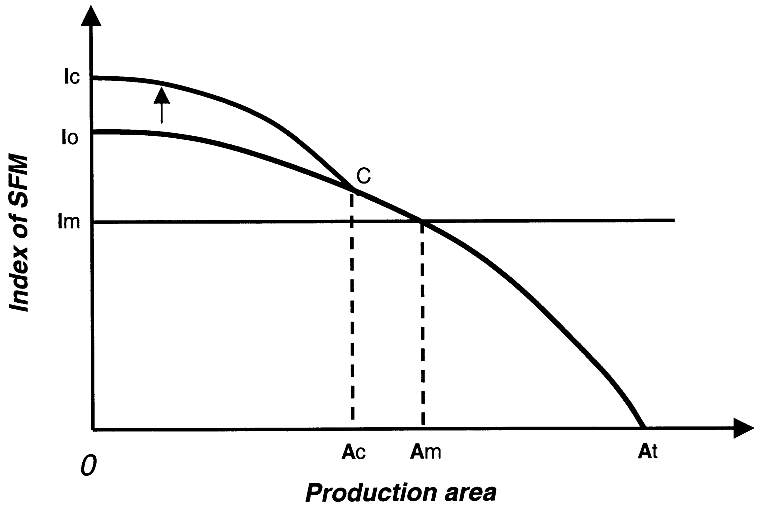

FIG. 3–Impact of certification across the production forest area.

follows the curve **Io**-**A**t. Before the introduction of certification standards, the production area that satisfied a minimum standard of sustainable forest management (**I**m) was **A**m. The certified area (**A**c) after certification was adopted by the main production forest owners, does not indicate an increase in the production forest area satisfying the minimum level, as those owners were already good performers. The original target of sustainable forest management certification was the area of production forests in the **A**m-**A**t segment of the diagram above, but very little, if anything, seems to have been achieved with these owners.

The next impact of forest certification will be the Chain of Custody processes that industrial companies are implementing for third-party suppliers. However, there still will be a number of marginal producers that cannot adopt the required standards and would prefer to supply local informal markets. The challenge of improving forest practices of small landowners is to become the focus of future efforts in public policies.

The quick expansion of sustainable forest management certification across tree plantation owners, who are the main industrial suppliers, does not mean, however, that all Chilean forests are sustainably managed. There are a few issues still not resolved: several native forest ecosystems are not represented in the National Wildland Protected Areas System; and some native species (*Araucaria araucana* (Molina) K.Koch and *Fitzroya cupressoides* I.M.Johnst.) have absolute harvest prohibition, even in private lands, thus affecting their value and conservation.

Overall, the widespread certification of industrial plantations has had the effect of bringing the main industrial forest owners to decide to halt any action that could lead to the conversion of native forests to tree plantations.

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APPENDIX

CERTIFICATION STANDARD BY COMPANY GROUPS, DECEMBER 2004

Company	ISO 14001	FSC	CERTFOR
Forestal y Agrícola Monteáguila S.A.	■	■	■
Terranova S.A. (ex Millalemu S.A.)	■	■	
Forestal Tornagaleones.	■	■	
Forestal Arauco S.A.	■		■
Forestal Celco S.A.	■		■
Bosques Arauco S.A.	■		■
Forestal Cholguán S.A.	■		■
Forestal Valdivia S.A.	■		■
Forestal Mininco S.A.	■		■
Forestal Quilpolemu S.A.	■		
Forestal Copihue (Bosques de Chile)			■
Volterra	■		
Basauri Group		■	
Forestal Bio Bío S.A.		■	
CAF El Álamo		■	
Probosque Ltda.		■	
Forestal Tierra Chilena Ltda.		■	
Forestal Anchile Ltda.		■	
Forestal Los Lagos S.A.		■	
PROCER - Promotora de Certificación Forestal		■	
ASTEX		■	
Bosques Cautin S.A.		■	
Sociedad Agrícola y Forestal Degenfeld Ltda.		■	