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Trade, Environment and Development: The Recent Argentine Experience

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The Recent Argentine Experience

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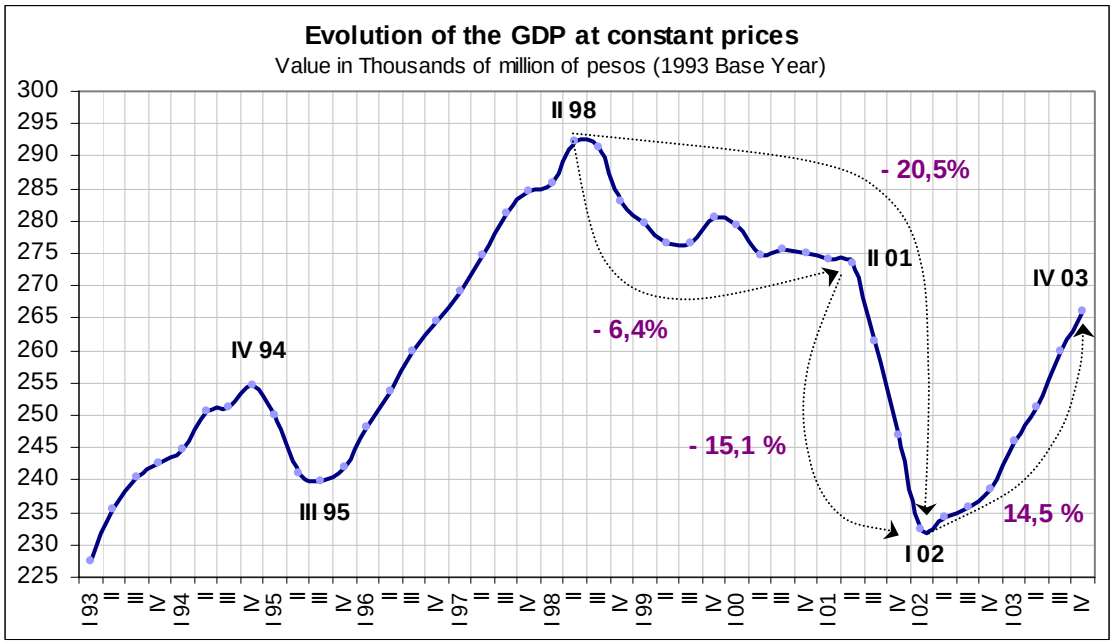
Introduction

In a context of ample international financing, first generation structural reforms were introduced in Argentina in the early 1990s. In particular, the liberalization of the trade and capital accounts and a massive privatization policy, as well as the Convertibility Plan, played a major role in the elimination of inflation and the resumption of economic growth.

The Argentine economy registered high growth in 1991-94. After a recession in 1995 – due to the financial crisis (the "tequila effect") – growth was also substantial in 1996-1998. Despite the growing inequality in income distribution and increasing unemployment, during the 1990s Argentina was considered the "poster child" for the implementation of the so-called Washington Consensus.

Figure 1: Evolution of GDP at Constant Prices (value in billions of pesos, 1993 base year)



Source: INDEC

With the external shocks following the Russian and Brazilian crises, the economy entered into a long recession in 1999-2000, and in 2001, into a financial, political, and institutional crisis. Argentina's GDP was reduced by more than 20% between the second quarter of 1998 and the first quarter of 2002 (see figure 1).

The huge external debt was defaulted on at the end of 2001, and at the beginning of 2002 the currency board was abandoned. The fall in the GDP and the huge devaluation of the peso sharply reduced imports and slightly increased exports, leading to a huge surplus in the current account that mitigated the large outflows of capital during 2001 and 2002. After a very difficult 2002, in which the economy collapsed, and the unemployment and poverty levels reached historical records, the economy is now growing again in a context of favorable international prices for commodities.

The crisis was the result of a perverse combination of a number of external (mostly the sudden stop in international financial flows) and internal factors (the overvaluation of the peso after the Brazilian devaluation and the euro devaluation vis à vis the US dollar, the huge external debt, fiscal policy constraints, and problems in the political alliance on which the government was based). The relative weights of these are assessed quite differently in the several academic studies available so far.

It will be several more years until Argentina is able to enter into the private international capital market again. At the same time, the very complicated external debt renegotiation, the restructuring of the financial sector, and the pending negotiations with the privatized public utilities companies are key issues to be faced.

In this context, the country is actively participating in the ongoing international and regional trade negotiations at WTO and FTAA to seek better access to its exports and with more concern about the concessions to be given in services and other issues than that shown during the GATT Uruguay Round.

At the same time, while MERCOSUR continues to be in the crisis in which it has been since the late 1990s, an emerging alliance with Brazil on some key international issues is visible, as in the case of the fight against subsidies in agriculture trade.

Increasing investment to enable continued growth and sharply reducing unemployment and poverty are certainly the priority questions the Argentine society faces on the development agenda in the years to come. These objectives are very difficult to achieve without building or rebuilding the institutions required to improve health, education, science, technology, justice, and human rights.

Although levels of pollution and the lack of management of natural resources are more serious than one would expect in a country at a middle level of income per capita, the environment has received very little attention in the development agenda. Whereas the long recession has probably not aggravated levels of industrial pollution, the recent large increase in poverty is likely to be a major cause of environmental degradation.

Despite this critical environmental background, little progress has been made on the environmental front, where the regulations are mostly of the command and control type and their enforcement is very limited.

Furthermore, "the most critical constraint for improving the management of pollution in Argentina is the absence of clear institutional responsibility for environmental management and the lack of effective enforcement" (World Bank, 1995), a statement that is still valid eight years after it was made.

The slow progress in the implementation of specific policies has meant that environmental problems are aggravated or improved primarily as a result of non-environmental policies.

Trade policies are one of these. In Argentina, these policies are result of a combination of unilateral liberalization and the regional integration that was officially launched in 1991 in the form of MERCOSUR.

In concert with the Convertibility Plan, tariffs on imported goods were sharply reduced in 1991. Imported capital goods had a zero tariff in 1993-95. Most non-tariff restrictions were eliminated, the automobile regime constituting the main exception during the 1990s.

In 1991-94 an automatic periodic reduction of tariffs in intraregional trade was implemented within MERCOSUR. After difficult negotiations for a common external tariff, a customs union for most trade items was agreed upon in 1995. Although trade has expanded significantly, the development of MERCOSUR has been uneven and has become conflictive since the Brazilian devaluation in early 1999.

Trade liberalization was carried out in Argentina without complementary policies. Although the government took some initiatives to deal with the specific problems of small and medium size enterprises (SMEs) and to foster innovation activities in the second half of the 1990s, these activities were not sufficient to counteract the uneven effects of trade liberalization.

Trade liberalization was implemented jointly with a strong reliance on foreign direct investment (FDI). The already liberal FDI regime was further liberalized in the early 1990s. FDI flows became quite significant in the 1990s. They were channeled first to the privatization of public companies and then to the take-over of many domestic private firms operating in both tradables and non-tradables. As a consequence of these flows, TNC affiliates' share in the sales of the largest one thousand Argentine firms increased from 39% to 67% between 1992 and 2000 (Chudnovsky and López, 2001).

Given this situation, the main purpose of this paper is to discuss the impact of trade liberalization (and higher FDI) on the environment in both the manufacturing and the agricultural sectors, relying on previous research work.

In this context, it is very important to bear in mind that whereas the evolution of manufacturing GDP has followed that of GDP as a whole (see figure 1), agricultural production in the Pampas has shown a steady growth pattern, reaching record levels in recent years, as shown in figure 2.

The key question around which this paper is organized is whether the significant acceleration of Argentine economic growth under trade liberalization and other structural reforms in the 1990s have brought with them environmental improvements, as argued by the advocates of trade and investment liberalization, or whether, as maintained by many environmentalists, they have occurred at the expense of the environment.

To answer this key question in the Argentine case, it is essential to distinguish between what trade liberalization has meant for the manufacturing sector and what it has meant for large-scale agriculture in the Pampas. Before shedding light on these basic issues in the Argentine case, it is useful to briefly summarize the central arguments of the debate.

Trade Liberalization, Growth and the Environment: Conflicting Arguments

To begin, it is important to bear in mind that the arguments advanced on both sides presuppose that there is a direct relationship between trade liberalization and economic growth.

This relationship has been questioned in the most recent literature (see Hallak and Levinsohn, 2004 for a good survey and a critique). From a theoretical perspective, it is based on a number of questionable assumptions, and, in practice, impacts depend upon a variety of factors, such as the country's history, the way trade liberalization is carried out, exchange rate policies, and the way institutions and policies deal with market failures. As a result, effects are far less automatic than is still assumed by orthodox theory and by some environmentalists.

The argument of the environmentalists is based on a *win-lose* scenario, in which trade liberalization, by stimulating economic growth, increases production levels (*scale effect*), which in turn could lead to higher pollution levels and might accelerate the exploitation of natural resources.

In addition, as long as market prices take into account neither the environmental costs nor the scarcity of resources, trade liberalization can, so their argument goes, lead to an inefficient allocation of resources. This process might directly affect the environment, since an undervaluation of these resources (whether renewable or non-renewable) could result in their over-exploitation or in the excessive use of polluting substances.

Trade liberalization would thus lead to an environmentally "dirtier" specialization in the production pattern if it involved an expansion of the most polluting or most natural-resource intensive activities. This *composition effect*, when added to the *scale effect*, results in a poorer environmental situation and a loss of social welfare.

From an opposite perspective, the advocates of trade liberalization maintain that the liberalization process could take place without major harm to the environment and might even be beneficial: a *win-win* scenario.

One of the arguments in defense of the positive effects of liberalized trade is that as an engine of economic growth, international trade leads to higher per capita incomes, which in turn may stimulate higher levels of environmental protection. This presupposes that there is a direct correlation between poverty and environmental degradation (as reflected in an environmental

Kuznets curve), in which increased per capita income levels are associated, *inter alia*, with an expansion of the services sector, the generation of the economic resources needed for the implementation of environmental policies, and the enhancement of social appreciation of the environment.

With regard to the internalization of environmental costs and externalities, although the existence of numerous market failures is widely acknowledged, the orthodox argument maintains that by eliminating distortions in the relative prices, the process of trade liberalization could result in a more efficient resource allocation. This in turn would limit the possible environmental harm of expanded production. In this sense, the composition effect would operate in such a way as to cause the inefficient activities to disappear as a result of increased competition in an open economy, while the other activities would improve their production efficiency. As a result, the ones that grow most would be the least-polluting ones – a cleaner pattern of specialization.

In addition, trade liberalization could facilitate the international diffusion of environmentally friendly production practices and technologies. By ensuring easier access to state-of-the art (and generally less polluting) technologies, this would also have a positive repercussion on the pattern of specialization, reducing the negative environmental effects of the growth of production.

Although it is true that trade liberalization (and foreign direct investment) may ensure access to environmentally friendly technologies, in order for a country to take advantage of them, an endogenous technological capacity is required to absorb and eventually adapt them to be compatible with local environmental systems. Specific policies are required to deal with the market failures in this learning process, but they are often ignored in the orthodox arguments.

With this conceptual background in mind, we can analyze the two contrasting experiences in the manufacturing and in the agriculture sectors.

Trade Liberalization and Environmental Management in the Manufacturing Sector

a) Export of Manufactures

When the environmental pattern of Argentine manufactured exports is analyzed, trade liberalization does not – contrary to the orthodox arguments – seem to have generated a "cleaner" exports pattern, nor has it led to a "dirtier" export pattern.

Argentina has a manufactured export pattern in which high and medium-polluting sectors predominate.[1] In 1990, these sectors accounted for 72% of the total manufactured exports. Despite the deep trade liberalization, the changes that occurred in the Argentine economy and the significant growth in export value, the relative weight of these sectors remained practically the same: in 1997, they represented 69% of the manufactured exports (table 1).

In the case of manufactured exports to OECD countries, the relative weight of the high and medium-polluting sectors increased from 68 to 76% for the same period, primarily due to the absolute and relative expansion of the medium-polluting sectors.

Within this predominance of high and medium-polluting sectors in Argentine exports, some important changes occurred in the three main groups used to classify the manufactured exports.

Among the high-polluting sectors, the dynamism of the petroleum-refining branch was insufficient to compensate for the relatively poor export performance of the other two main activities in this group: chemical and iron and steel industries.

Table 1: Total Manufacturing Exports According to their Polluting Potential, 1990-1997, US$ Million and percentages

	Exports to the whole world					
Manufacturing sectors (According to CIIU and their ordering in the Human Toxicity Index)	**1990**	**% sector in manufacturing exports**	**1994**	**% sector in manufacturing exports**	**1997**	**% sector in manufacturing exports**
High polluting potential	**3,803.77**	**41.76**	**4,205.23**	**34.00**	**6,505.20**	**34.32**
353. Petroleum refining	985.17	10.81	1,651.20	13.35	2,933.46	15.47
351. Manuf. of chem. subst. basic ind exc manure	880.99	9.67	692.65	5.60	976.29	5.15
323. Leather industry	579.85	6.37	948.46	7.67	1,002.68	5.29
371. Basic industries iron and steel	828.37	9.09	503.58	4.07	877.05	4.63
372. Non-ferrous Metals	305.02	3.35	201.87	1.63	292.57	1.57
341. Manufacture of paper	195.95	2.15	127.80	1.03	306.04	1.61
Medium polluting potential	**2,797.98**	**30.72**	**4,302.21**	**34.79**	**6,586.68**	**34.75**
3115. Manufacture of oils and fats	2,288.90	25.13	2,817.98	22.79	4,524.13	23.87

382a. Non-electrical machinery of medium polluting potential	166.32	1.83	299.61	2.42	549.32	2.90
352. Other chemical products	108.72	1.19	306.99	2.48	568.61	3.00
Low polluting potential	**2,507.63**	**27.53**	**3,859.79**	**31.21**	**5,865.29**	**30.94**
311. Food exc. Oils and fats	1,853.10	20.34	2,259.72	18.27	2,266.56	11.96
384. Transport equipment exc. naval constr.	202.86	2.23	871.27	7.04	2,906.44	15.33
313. Beverages	65.98	0.72	79.78	0.65	225.34	1.19
Subtotal (high, medium and low polluting potential)	**9,109.38**	**100.00**	**12,367.23**	**100.00**	**18,957.18**	**100.00**
Total exports	**12,352.53**		**15,839.21**		**26,264.37**	

Source: Chudnovsky et al (1999)

The expansion of the exports of oils and fats (agro-food products) accounts almost entirely for the higher relative weight of the medium-polluting sector in the Argentine export pattern, while the expansion of the automotive industry accounts for much of the export performance of the low-polluting sector.

However, even though Argentina continues to have a pattern of exports dominated by high and medium-polluting industries, in 1998 this pattern seemed less subject to international environmental requirements than it did at the beginning of the decade.

In that context, the most significant feature of the export profile of Argentina in the 1990s is the growing relevance of the MERCOSUR and the loss of weight of the industrialized countries as destinations of Argentine exports prior to the Brazilian devaluation of 1999. In addition, while manufactures constituted a major portion of exports to the MERCOSUR (especially automobiles and automobile parts), more than 80% of the exports to the OECD area were natural resource-intensive products, especially agro-food products (which represented 36% of these exports).

In any event, the loss of relative weight of Argentine exports to industrialized countries reduces, though does not eliminate, the pressure of environmental regulations and norms of these countries on local producers.

b) Environmental Management

Although trade liberalization alone has thus not affected the environmental pattern of Argentine exports, the increased competition resulting from it in tradeables markets, together with easier access to more environmentally friendly machinery and equipment, does appear to have induced some export firms to improve their environmental management (EM).

Argentine manufacturing firms, which had been highly protected during the import substitution industrialization (ISI) phase, were expected by the government to rapidly restructure in order to improve efficiency in order to compete with imported goods in the domestic market as well as to increase their exports.

Trade liberalization has indeed been a powerful force to induce firms to reduce costs, to upgrade their technologies to become more competitive, and to introduce EM. These processes may also have had favorable environmental consequences in some cases: through reductions in the consumption of energy and raw materials, waste minimization, adoption of environmentally friendly products, etc.

Although no official statistics exist on either the resources devoted to environmental protection or the pollution levels generated by manufacturing industry, the following evidence is available on EM in large and small firms operating in the Argentine industry in the late1990s.

Environmental Management in Large Firms

While local environmental regulations[2] are quite stringent, there is a wide consensus that their enforcement is weak due to the lack of political will and/or resources to adequately monitor the environmental performance of local producers. This fact is aggravated by the existence of

multiple regulations on the same resource: even though the provinces retain all the power over their natural resources and their environment, national environmental regulations have also been put in place.

Nonetheless, due to pressures from consumers and local communities, foreign customers' requirements, and so forth, the environmental performance – or at least the EM methods – in place in Argentine industry may have improved in the 1990s, especially in large firms. The rise in the number of ISO 14000 certifications (from 9 in 1997 to 163 by the end of 2001) is a reflection of this trend.

The data available on private environmental expenditures suggest that the resources devoted to environmental protection by industrial firms have increased in the last decade.

Environmental expenditures by members of the Argentine Business Council for Sustainable Development (ABCSD)[3] grew slowly from US$ 40 to US$ 55 million from 1994 to 1999, then abruptly increased in 1999 and 2000, reaching US$ 120 million. Unfortunately, no information is available on the breakdown and objectives of these environmental expenditures.

The information collected in our research suggests that the increase in environmental expenditures is associated not only with the need to comply with domestic regulations, but also with other factors:

- the need to meet stringent environmental standards in export markets;
- in the case of TNC affiliates, global corporate environmental policies may entail some requirements stricter than those in force in Argentina;
- the need to improve the environmental "reputation" of the firms;
- the possibility of realizing cost reductions through such measures as waste recovery and energy or raw material savings (Chudnovsky *et al*, 1996).

In some highly polluting sectors, such as pulp and paper, steel, petrochemicals, and tanning, we found that firms started to improve their EM in parallel with their restructuring efforts. This occurred in a context of greater competition through trade liberalization, regional integration within MERCOSUR, and growing FDI inflows (Chudnovsky and Chidiak, 1996; Chudnovsky *et al*, 1996). Export oriented firms were especially likely to improve their environmental performance as a result of the requirements in foreign markets. In turn, similar improvements in EM have been reported in other studies carried out in the pharmaceutical and food processing industries, though the motivations differed in each sector (FIEL, 1996).

The above-mentioned studies found that a better environmental performance has often been achieved as a by-product of the efforts made to reduce costs and increase production efficiency to face the growing competition in domestic and export markets.

These studies also found that end of pipe (EOP) treatment was unevenly implemented in many facilities, and there was limited evidence of pollution prevention (PP) and waste minimization activities. While several firms had undertaken process optimization and waste re-use activities as part of their efforts to reduce costs and save energy, only a few enterprises had adopted PP technologies (Chudnovsky *et al*, 1996; Chudnovsky & Chidiak, 1996).

We noted that advances in EM varied not only among different types of firms, but also among sectors. For instance, more export-oriented sectors seemed to be more prone to adopt modern EM systems. In addition, key variables explaining the differences in terms of EM and rate of adoption of PP measures were not only the size of the firms, but also other elements such as the origin of their capital (TNCs affiliates appeared more advanced than local firms) and the age of their facilities (modern plants were generally "greener" than older ones).

Another issue we highlighted was that environmental spillovers from large firms to their small and medium suppliers and customers seemed to be very weak. It was also clear that environmental practices leading to a positive economic return were adopted first.

Even though the issue of the relationships between innovation and EM was not systematically explored in that study, Chudnovsky and Chidiak (1996) suggested that the adoption of measures aimed at saving energy and raw materials or at minimizing wastes had implied some minor technology improvements based mainly on endogenous capabilities. However, weak domestic innovation capabilities could pose a limit to the adoption of more ambitious "eco-efficient" measures, which often require *ad-hoc* solutions to highly specific problems.

To discuss these issues in depth, we conducted a survey of 32 large firms operating in different sectors in Argentina (chemicals, petrochemicals, motor car, machinery, steel, oil, textiles, etc) in 1996-1997. It was prepared and distributed jointly with the ABCSD – 24 of the firms surveyed belonged to the ABCSD. The main findings of the study are reported in Chudnovsky, López and Freylejer (1997) and are summarized below.

In order to analyze the main research issues, three indicators were defined to reflect, respectively, the EM level, the adoption of PP practices, and the quality and innovation capabilities of firms.

The following variables were included in the EM indicator: existence of a formal EM department; number of people involved in environmental protection activities; monitoring of environmental indicators and goals; environmental targets; environmental accounting system; environmental investments registration; percentage of R&D expenditures geared to environmental issues; the implementation of studies on environmental impacts of product/process and on raw materials recycling; analysis of possibilities of using environmentally friendly raw materials and/or technologies; interactions with customers and/or suppliers; adoption of PP measures, and environmental certifications.

The PP indicator was estimated assessing the importance granted by the firms to the following measures: maintenance and operation practices; staff training; customer/supplier cooperation schemes; energy, water and input savings; product and/or process reformulation; raw material substitution; modifications of existing processes; adoption of clean technologies; and external recycling.

Finally, the quality and innovative capabilities indicator was estimated through the following variables: R&D expenditures as percentage of sales; number of engineers, professionals and scientists as percentage of total employment; and quality certifications obtained or in progress.

We found that more than 90% of the large firms surveyed had an environmental department. In addition, they had defined their own environmental policies and had also established targets for

their environmental performance. Moreover, all these firms had staff working exclusively assigned to EM, though not often full time personnel. These enterprises were well aware of local and international environmental regulations. All of them had adopted primary and secondary treatment facilities or similar EOP facilities. 92% of surveyed firms carried out environmental training of their staff and almost 13% of them had achieved one environmental certification (ISO 14000), while another 40% had at least one in progress.

PP practices had been adopted by surveyed firms as part of their EM. As would be expected, measures adopted were "simpler" ones (energy, water and input savings, followed by good housekeeping, maintenance and operating practices and staff training). More "complex" measures (e.g. process modifications, cleaner new technology adoptions, raw material substitution, and product reformulation) were less important.

EM was stronger in export oriented firms than in those geared to the domestic market. Most of surveyed export firms had already obtained an ISO 9000 certification while only 25% of the firms selling to the domestic market had that same certification. The same trend was also visible with ISO 14000 certifications, though the diffusion of the latter was still incipient. Regarding the diffusion of PP measures, weak PP management was more often found in firms mostly selling to the domestic market than in export oriented ones.

As expected, there was also a difference in EM between foreign and domestic enterprises. Broadly speaking, active EM was more common in foreign firms than in domestic ones. Nevertheless, there were also a greater percentage of foreign firms with weak EM. In the specific case of TNCs with weaker EM, it is unlikely that they were behaving as "environmental refugees." In fact, they were firms that had recently been purchased by foreign investors and where environmental practices had been inherited from the previous local owners.

Meanwhile, most foreign enterprises with an active EM were applying the global policies defined by their headquarters, even though, in some cases, the subsidiaries kept some autonomy to react to specific local circumstances. Furthermore, on average, PP measures had been more adopted by TNC subsidiaries than by domestic firms.

Regarding the barriers to the adoption of PP measures, access to cleaner technologies was the main obstacle faced by the firms. Although this barrier was more frequent among domestic enterprises, it was also significant among TNC subsidiaries. Furthermore, a lack of monetary and/or human resources also constrained the adoption of PP measures, especially among domestic firms.

In-house activities were the main source for the technologies required to adopt PP measures, especially for those measures with easy implementation and/or where the problems were firm-specific. Not surprisingly, other sources were as important as in-house activities when product reformulation or the adoption of a cleaner technology was required.

As expected, the headquarters appeared to be a substantial source of technology for foreign enterprises. Besides that key source, other sources that TNC affiliates relied on for their technological inputs included specialized local enterprises (instead of foreign ones) and, to some extent, local universities and/or research institutes. In contrast, besides the role of in-house activities as the main source of technology, domestic firms also relied on specialized foreign

firms (instead of domestic ones) and they had few links with local universities and/or research institutes.

A positive relationship was found between innovatory capabilities/quality management and EM and adoption of PP measures (tables 2 and 3). This finding is a clear reflection of the importance of endogenous technological capabilities in the development of proper EM.

Table 2: Environmental management according to firms´ innovative capabilities, 1997 (percentages)

Innovative capabilities:	Weak EM	Medium EM	Active EM	Total
Low (10 firms)	30	60	10	100
Medium (10 firms)	20	30	50	100
High (12 firms)	8	42	50	100

Source: Chudnovsky, López & Freylejer (1997)

Table 3: PP management according to firms´ innovative capabilities, 1997 (percentages)

Innovative capabilities:	Weak PP management	Medium PP management	Active PP management	Total
Low (10 firms)	50	30	20	100
Medium (10 firms)	20	30	50	100
High (12 firms)	17	33	50	100

Source: Chudnovsky, López & Freylejer (1997)

Environmental Management in Small and Medium Enterprises (SMEs)

In the same study, we were able to analyze a survey given to 120 manufacturing SMEs in many different sectors at Gran Buenos Aires in 1997. The results shed light on a few aspects of EM in that group of firms.

As expected, the SMEs surveyed showed strong deficiencies in their EM. For instance, only 20% of them had EOP facilities. Likewise, most of the SMEs (60%) did not have environmental performance targets and, in several cases, did not even know the current national and provincial environmental regulations. Hence, it comes as no surprise to find that EM in SMEs was much weaker than in large firms,[4] and that the diffusion of PP measures was much more limited (table 4).

According to the survey, the lack of access to modern technologies was the principal constraint to the adoption of PP measures among SMEs. In addition, lack of information was also a central obstacle for many of the SMEs surveyed. Another crucial finding was that more than 25% of

SMEs had not been able to point out the main difficulties they faced in being able to improve their EM.

Table 4: Diffusion of PP practices in SMEs and Large Firms, 1997 (percentages)

	SMEs	Large firms
Preventive maintenance	41	84
Energy, water and inputs savings	32	91
Workforce training	26	81
Process modifications through cleaner technologies	22	59
Process modifications through existing technologies	21	66
Substitution of inputs and raw materials	20	56
External recycling	16	66
Product reformulation	14	41

Source: Chudnovsky, López & Freylejer (1997)

Finally, more recent information on EM is reported in the Second National Survey on innovation activities in the manufacturing industry in 1998-2001 (INDEC, 2003).

Half of the 1688 enterprises surveyed had at least one EM activity (mostly related with end of pipe facilities, improvement in the use of water and energy and internal or external recycling). While almost all large firms (93%) had at least one EM activity, only half of the SMEs had implemented environmental measures. With respect to the nationality of the firms, 79% of the 403 foreign owned surveyed firms and only 41% of the 1285 nationally owned firms in the survey indicated activities related to EM.

It is interesting to note that the incorporation of end of pipe facilities has been the most frequent activity within EM. Improvements in resource use and recycling were the second most frequent activities in the mentioned survey. The main reasons for adopting active EM among large firms were local regulations, corporate image and intrafirm standards (in the case of foreign owned firms).

To summarize, environmental improvements have been part of a cost-reducing strategy and have been focused on the more integral utilization of resource inputs and residues, as well as – though to a lesser degree – on the treatment of pollutants. Nevertheless, these improvements remain far from the best international standards, both for the large firms and especially for the small and medium-sized ones. As such, in absolute terms, the level of polluting emissions has probably not been reduced.

Under these circumstances, while the trade liberalization process has been far from generating a *win-win* situation in the manufacturing sector, it can also not be said that the environmental quality has generally deteriorated and led to a *win-lose* situation, especially if one takes into account the improvements in the environmental management of the large firms with a high export profile.

Nevertheless, the fact remains that although per capita income levels grew substantially until 1998, there appears to have been no corresponding improvement in environmental protection. The lack of public interest in environmental themes is reflected in a dearth of specific policies and a low level of enforcement of existing environmental regulations – key conditions for any *win-win* situation to occur in the manufacturing sector. In other words, a cleaner export pattern with reduced emissions from the sectors that are potentially most polluting and the appearance of export goods produced by more environmentally friendly processes has not emerged during the growth phase.

Now that the recession and crisis are over, further progress will depend on advances in environmental regulation at national and regional levels in MERCOSUR and on the preference that industrial as well as the ultimate consumers give to environmentally friendly products. Improvements will also require the definition of environmental indicators appropriate for local production processes and environmental conditions, as well as on progress in the design and implementation of adequate environmental and technological policies at the local level.

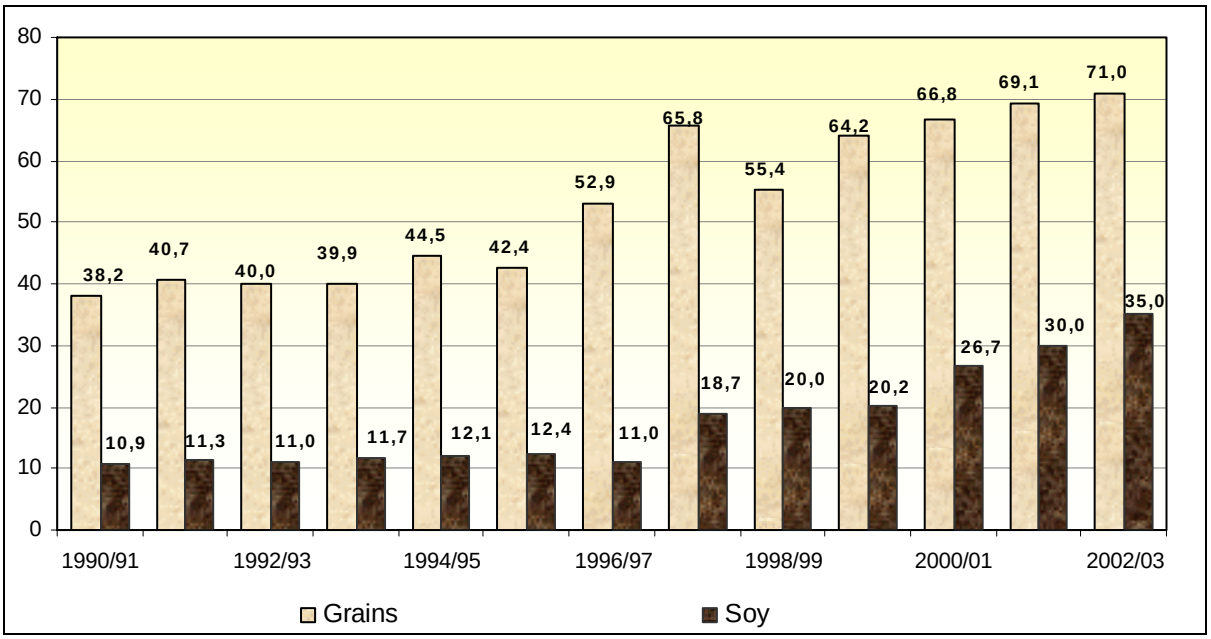
In that sense, top priority will have to be given in the manufacturing sector to the generation, adaptation and dissemination of clean technologies, especially among small and medium size firms.

The Diffusion of Transgenic Crops in the Agricultural Sector[5]

The intensification of agricultural production in Argentina during the 1990s constitutes one of the positive impacts of the structural reforms and economic policies implemented at the beginning of that decade.

The elimination of taxes and withholdings on agricultural exports, the substantial reduction of import tariffs on inputs and capital goods, and the deregulation of some markets all created favorable macroeconomic conditions and paved the way for a large expansion of production volumes for cereals and oilseeds (from 26 million tons in 1988–1989 to over 70 million in 2002–2003), and particularly for soy, which soon became Argentina's leading export (see figure 2) The increase in export value occurred within a context of erratic international prices and in the face of competition with other countries that, unlike Argentina, profit from government subsidies to production and exports.

Figure 2: Agricultural Production in Millions of Tonnes



Source: Agriculture Secretary

This growth in agricultural production is the result primarily of a substantial expansion of the planted area (mainly at the expense of livestock) derived from a significant adoption of new technologies, notably the introduction of transgenic crops to Argentine agriculture. As a result of this increase in the planted area, the Pampas agricultural sector succeeded in reversing labor dismissal trends observable over previous years and went on to generate nearly 200,000 jobs from 1993 to 1999.

The process of adoption of technologies involves the procurement of capital goods, fertilizers, and agrochemicals (herbicides and pesticides), as well as a momentous change in terms of genetic inputs: the introduction of transgenic crops in Argentine agriculture.

The first transgenic crop commercially released into the Argentine market (in 1996) was soybean tolerant to glyphosate herbicide (RR soybean). Later on, transgenic varieties of corn and cotton tolerant to herbicides and resistant to insects were approved by the local authorities.

Since its release date, the rate of expansion of RR soybean in Argentina has increased considerably, exhibiting a growth even higher than that in the United States, which was the first country to introduce this kind of crop. The area planted to RR soybean shot up from less than 1% of the total area planted to soybeans in the 1996/97 season to more than 90% (around 9 million hectares) in the 2000/01 season. The adoption of lepidoptera-resistant corn has also been significant, yet with values lower than those observed for soybeans, accounting for 20% of the total cultivated area during the 2000/01 farming season (the third year since its introduction). The diffusion of Bt cotton has, for its part, been very limited, amounting to 7-8% of the total planted area.

At present, Argentina ranks second only to the United States in terms of agricultural surface cultivated with transgenic crops and is therefore a major player in the international arena.

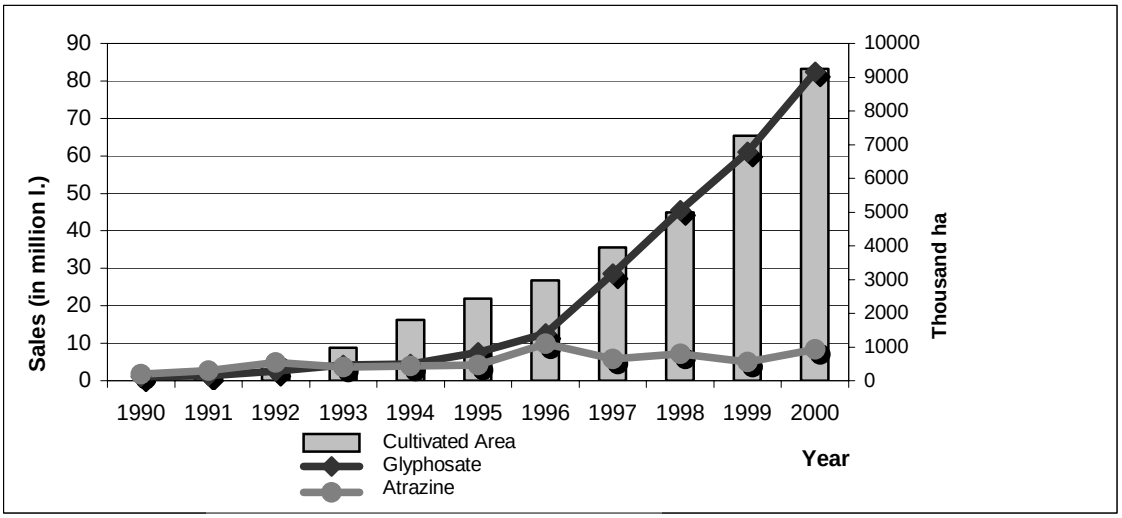
The sharp increase of Argentine agricultural production during the last decade has taken place hand in hand with the outstanding increase of no-till cultivation[6] as the main farming practice for the Pampas crops (favored by the reduction in import tariffs on the agricultural machinery). The use of the no-till planting system rose from approximately 300,000 hectares in the 1990/91 season to over nine million hectares in the 2000/01 season. This technology constituted an important factor in the expansion of production, as it increased the area cultivated with late-planted soybean (planted after the wheat harvest) to new production areas. During the 1999/2000 season, for example, this translated into a virtual increment of 3 million hectares of arable land.

The combination of no-till planting techniques with RR soybean joins two technological concepts: new mechanical technologies that modify crop interaction with the soil; and the utilization of general-use, full range herbicides (especially glyphosate) that are environmentally neutral, due to their high effectiveness in controlling all types of weeds and their lack of residual effects. While both factors imply a more intense use of inputs, this intensification is, at the same time, deemed "virtuous," because it simultaneously lowered the consumption of herbicides with the highest toxicity level, as shown in figure 3.

It is worth noting that even after the increase in the use of agrochemicals throughout the period, the total use per hectare of arable land was still far below that recorded in competing countries. Furthermore, the utilization of agrochemicals appears to have stabilized after the 1996/97 season. If we also consider the favorable externalities generated through the progressive recovery of soil fertility along with other potential impacts – such as benefits on the greenhouse effect reaped from this type of practices – it seems that the overall environmental impact of these transformations has been positive, at least up to 2001.

From this perspective, Argentina would fit into a win-win situation in which commercial release facilitated the expansion of agricultural production at the same time that it fostered the adoption of environmentally friendly technologies developed abroad. Therefore, this technological package seems to have produced positive effects from the social point of view as well, for it stimulated an increase in jobs in the agricultural sector. Moreover, the significance of this effect is reinforced by the fact that it took place simultaneously with an increase in labor productivity within the sector and during a period in which the rise in unemployment rate constituted one of Argentina's thorniest social problems.

Figure 3: Evolution of no-till techniques and composition of the type of herbicides used in Argentine agriculture



Source: Trigo et al, 2002

Argentina enjoyed favorable conditions for a rapid adoption of genetically modified organisms (GMOs). The Argentine seed industry profited from the active participation of national companies and subsidiaries of multinational corporations as well as public institutions. To top it off, the country also cherished a long-standing tradition in the field of germplasm improvement. At the same time, momentous institutional decisions were made, particularly with regard to biosafety regulations, with the creation of the Advisory Committee on Agriculture Biotechnology (CONABIA) in 1991 being one of the most important ones.

The aforementioned elements, along with the fact that Argentina constitutes the major area (amounting to 26 million ha of cultivable land) for the potential use of new technologies outside their country of origin, provided the proper incentives and a most suitable "landing field" for the rapid adoption of these biotechnological inputs.

By contrast, public (and private) resources allocated to research and development in Argentine agriculture – especially in the area of biotechnology – are scarce in comparison to corresponding efforts at the international level. Beyond their meaningful contribution to R&D activities on some crops (such as alfalfa) and in the sphere of veterinary science, institutes devoted to agricultural biotechnology research in Argentina have hardly participated in the events approved by the CONABIA. Multinational companies have taken the lead in the process of releasing new technologies into the environment in Argentina as in many other countries.

The massive adoption of the RR soybean can be accounted for by the reduction in production costs (regardless of the size of the crop farm) and, above all, by the expansion of cultivable area brought about by said variety. These elements are not distinctive of the Argentine case. What is distinctive in this specific case, however, has been the instrumental role played by certain idiosyncratic institutional factors in the rapid and effective expansion of RR soybean.

The first factor refers to the manner in which the RR gene was first transferred to Argentina. Originally, access to the RR gene was achieved through negotiations between Asgrow and Monsanto in the United States, whereby Asgrow Argentina was granted the use of the gene in its registered varieties. Later on, when Nidera acquired Asgrow Argentina, it gained access to the gene and widely disseminated it in Argentina. Consequently, when Monsanto tried to patent the gene in Argentina, it was unable to do so because it had already been "released." However, through private settlements that expressly identify the ownership over this patent and stipulate the royalties to be paid, Monsanto was able to license the RR gene to other companies that commercialize it in Argentina. Therefore, conditions were never met for the breeder company (i.e. Monsanto) to be entitled to charge the technology fee nor to restrict the use of the seed by farmers, as is the case in the United States.

The second factor is related to the operational aspects of the seed market and its effect on the price of RR soybean. On the one hand, under the UPOV Convention of 1978, farmers can legitimately keep seeds for their own use; on the other hand, there are clandestine operations (the so-called "white bag") through which seed multipliers offer seed without the authorization of the companies holding the corresponding legal production rights. Both factors have driven down the price of RR soybean, thus promoting the rapid adoption of said technology.

Within this context, the stunted growth of the seed market over the last years should come as no surprise, regardless of the sharp increase observed in the acreage planted to soybean, the leading crop in the market. Therefore, the plateau experienced by the seed market since 1996/97 may be explained by the introduction of transgenic seed and the resulting need to obtain original seed on the part of farmers (and even of clandestine seed producers). The use of "white bag" seed as well as of farmers' own seed would account for the evolution of the market in the following years, a practice which surely had an impact on the substantial reduction in the price of RR soybean seed as compared to that of conventional seed during the 1999/2000 period.

It should be noted that this situation is also linked to the fact that soybean seed falls into the category of autogamous species, in which genetic quality can be maintained through seed retained by farmers for their own use or through clandestine multiplication practices. Along these lines, we should also take into account the relevance of the widespread adoption of the wheat-soybean double-crop system during the period under analysis, which undoubtedly constituted an additional inducement to keeping seeds for the next season.

The third factor contributing to the wide diffusion of RR soybean in Argentina was the reduction in the price of glyphosate, which stemmed from a fiercer competition in local markets as a result of the introduction of new agents in the manufacturing and commercialization of the product.[7]

Keeping in mind that so far Argentina has encountered no difficulties in accessing target markets for its RR soybean exports and that, in spite of the perceptions of foreign consumers, price differentials between conventional and RR soybeans in the world market do not penalize the latter, it is hardly surprising that almost all the Argentine soybean crop is RR. Neither is it surprising that it is not only input suppliers that are in favor of this new technology, but that farmers, the scientific community, and government authorities also support it (though the issue of monocropping has recently been raised, as will be seen below). Only a few NGOs, particularly Greenpeace, have introduced part of the international debate in Argentina. Yet Argentine public

opinion has offered so far not much fertile ground for negative views about these new technologies, as it is overwhelmed by major issues such as unemployment, poverty, and corruption, while anti-globalization campaigns have focused their criticism on banks and privatized companies.

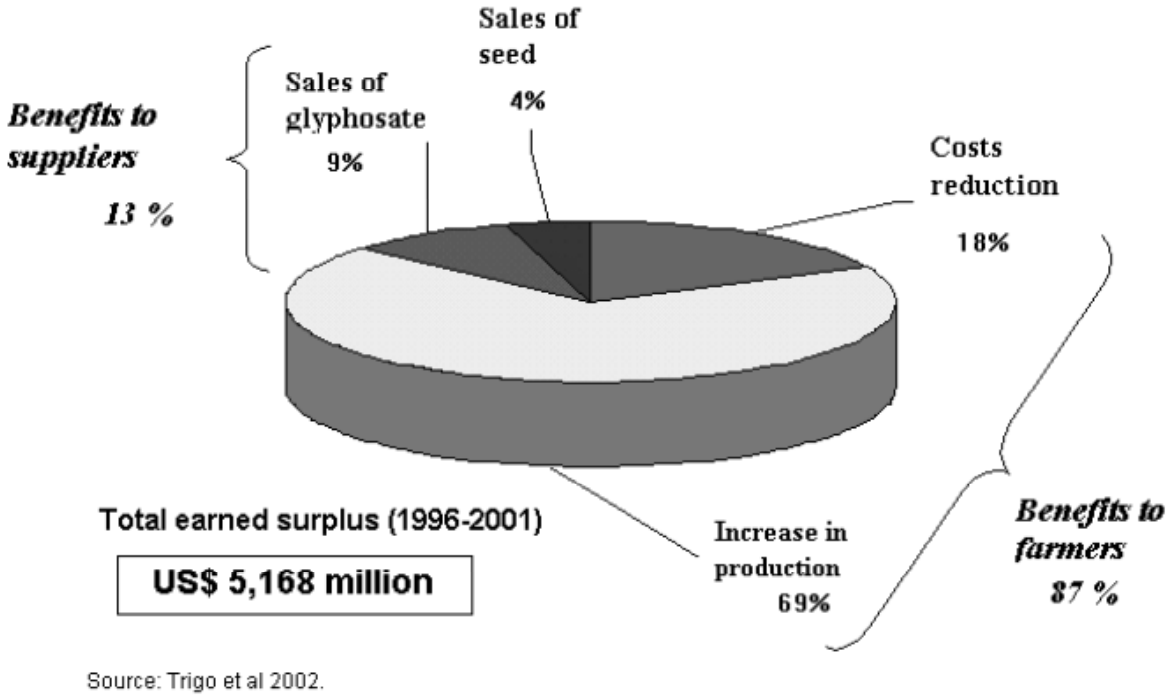
Unlike RR soybean, Bt corn and Bt cotton have shown a much less dynamic performance. First, Bt varieties were released much more recently, and second, farmers tend to consider Bt crops to be a sort of insurance, yielding higher or lower profits depending on pest behavior during each season. In addition, a technology fee charged to farmers is applicable to transgenic corn and cotton varieties and, in some cases, this fee is higher than in the United States. This is related to the fact that in both crops there are patent applications and that, in the case of corn, it is a hybrid variety. As a consequence, farmers may not keep their own seed for planting, and therefore, the relative weight of the certified seed in the corresponding market increases.

As far as cotton is concerned, the real issue lies on the commercialization strategy, which is based on formal agreements between the sole supplying company and the farmers, whereby the latter's right to their "own use" of the seed is restricted. As a result, farmers have no choice but to pay four times the price of conventional varieties. This, in turn, hinders the diffusion of this technology in the country.

It is clear from the above discussion that one of the main problems in Argentine agriculture is the illegal trade of seeds, amounting to 35-50% of the market.[8] Besides the risks that this situation might entail in terms of a potential reduction in productivity (seed with lower genetic quality and germinatory power) or with respect to phyto-sanitary issues, the existence and growth of illegal practices might also mean that many of the breakthroughs in biotechnology – and in other conventional technologies as well – may not find an effective way to be incorporated into production. In other words, the dissemination of new knowledge takes much longer than it actually would if the seed market worked under normal conditions. The dissolution of the National Institute of Seeds (INASE) at the end of 2000 aggravated the situation, as it constituted the regulating authority responsible for the enforcement of effective rules and regulations. Hence, at present, there has been no clear reassignment of responsibilities for policing within the sector. This has extended to the GMOs market given that, in terms of sanctions, GMOs are regulated by the same rules and regulations applicable to the conventional seed market.[9]

Finally, some clear and obvious differences arise from the comparison of RR soybean to both Bt corn and Bt cotton. In the case of soybean, the fact that the adoption of this new technology has proved neutral to farm size, on the one hand, and the distribution of benefits among input suppliers, farmers and the Argentine economy as a whole has been equitable, on the other hand (see figure 4) clearly indicate that this is a *win-win* scenario.

Figure 4: RR Soybean Adoption: Benefits Distribution



Source: Trigo et al 2002.

The evidence available for Bt corn and Bt cotton (see table 5) does not point in the same direction, although the performance actually observed in these cases does not differ much from the one found in other contexts. It can thereby be concluded that the situation herein depicted is not attributable to country-specific conditions but rather to results stemming from the nature of these technologies and to the way in which this has been reflected in the performance of the actors in the process of adopting said technologies.

Table 5: Transgenics in Argentine Agriculture: Distribution of Gross Accumulated Benefits (percentages)

Case		**Farmers**	**Input providers**
SOYBEAN RR	With “white bag”	**82**	18
	Without “white bag”	**87**	13
COTTON Bt		17	**83**
MAIZE Bt		21	**79**
Source: Trigo et al, 2002			

From this perspective, the soybean case in the Pampas would fit into a *win-win* situation in which the sharp expansion of agricultural production has not had a negative effect on the environment thanks to the adoption of environmentally-friendly technologies developed abroad.

Nonetheless, the extraordinary success of the RR soybean should be taken more cautiously if a long-term view is considered.

First, an excessive reliance on this crop, pushed by the high international prices, may affect the fertility of the soil. In this connection, a report by the National Institute of Agriculture Technology states that the "no tillage system + RR soybean" cannot continue as a sustainable strategy without rotating crops in the Pampas (INTA, 2003). At the same time, the "agriculturization" process in the northeast and west of the country – due to the soybean expansion – is not sustainable in these ecologically fragile areas. Both processes could affect the quantity and quality of the country's natural resources and lead to a fall in agricultural production.

Although, according to INTA, more sustainable production methods (based on rotation with maize and livestock) are available and are being adopted by some farmers despite their higher operating costs, the fact that 50% of the land is leased and the price of the lease is fixed in kg of soybeans is a serious constraint for the diffusion of these methods.

Second, the long-term environmental effects of the RR soy + glyphosate + no-till technological package have not yet been studied.

Third, the trend towards a differentiated world market for GMO and non-GMO products in view of the increasing eco-labeling requirements in import markets (to meet the consumer fears on these type of food items) may negatively affect the prices in which Argentine producers sell their oil seeds. Finally, the way the WTO proceeds in the conflict regarding the GMO moratorium between the European Union and the United States, Canada, Argentina and other GMO producing countries may also influence Argentine exports in the world market.

At the same time, the domestic policy process regarding biotechnology should be reexamined. It would be quite important to analyze ways in which leading stakeholders could become more responsible for the long-term effects of these technology advances, as well as to incorporate the participation of stakeholders that have been largely ignored in the policy process, such as Parliament, consumers, and environmental NGOs. Furthermore, possibilities should be considered to increase resources to allow the participation of local firms and institutions in the research and monitoring processes that so far have been influenced primarily by affiliates of foreign companies.

Concluding Remarks and Policy Suggestions

In a country in which the overall development record in the 1990s (and indeed in most of the 20th century) has generally been so poor and where the experiment of currency board and structural reforms ended in the worst economic crisis in the country's history, it is very difficult not to be pessimistic.

However, the experience with the introduction of no-till cultivation and RR soy in the agricultural sector in the Pampas documents a situation in which production expansion has not damaged the environment (at least as of 2001) and has mostly benefited farmers rather than input suppliers, contrary to the assumptions of those who oppose this new technology.

What happened with RR soy has clearly not occurred in the case of Bt corn and cotton. It is also not clear what will happen in the near future with soy and other GMO crops in a complex international context, in which agricultural protectionism is not easily disciplined and consumer attitudes are hard to predict.

At the same time, it is important to keep in mind that the social and environmental conditions in other agricultural activities in Argentina are certainly not the same as those examined in this paper.

The trade-environment relationship in the manufacturing area is not as bad as one could have expected in a country in which trade liberalization was carried out in a shock basis, with an overvalued exchange rate, and without complementary innovation and enterprise policies. Some progress was made in the diffusion of modern environmental management techniques to counteract the scale effect on the environment in manufacturing industry. However, this development has been limited to a handful of large and mostly foreign-owned enterprises, and no information is available to document the extent to which emissions have been controlled in those firms. Furthermore, these environmental efforts seem to be islands in a sea of SMEs that in their survival strategies pay relatively little attention to environmental matters.

The unique experience of Argentina with RR soy and no-till cannot be ignored in the ongoing international debate on the pros and cons associated to the impact of agricultural biotechnologies. However, it cannot easily be generalized to other Latin American countries (even to Brazil, which is a large soy producer and where the diffusion of this technology has led to great controversy).

In contrast, what we have found in the manufacturing sector in Argentina is quite similar to the evidence available on other countries, especially in Brazil (see the paper by Carlos Young in this volume).

To make more progress in the trade-environment-development nexus, it is important to keep our countries open to international flows of technology and investment. But imported inputs do not substitute for the process of development of indigenous capabilities. This is a key issue that was not properly acknowledged in the design and implementation of the reforms in the last decade, which basically ignored the significance of market failures.

Hence, it is of the utmost importance to learn and conduct more research on the impact of trade and foreign direct investment liberalization in our countries and, at the same time, to design and implement adequate enterprise, environmental, and innovation policies, including the management and monitoring of agriculture biotechnologies.

Some initiatives in this area have been taken in Argentina and other Latin American countries in the 1990s, but they generally remain in the margin of the policy agenda and of the second-generation reforms.

Besides the political will, one of the main constraints to moving ahead in this area is certainly the quality of the government agencies and of the institutions to deal with the coordination and market failures that prevail in this field in general.

This is a critical constraint for most developing countries, but other countries may be in a better condition than Argentina to undertake the institutional building process to deal with these failures.

Although the task of designing and implementing adequate enterprise, environmental and innovation policies is mainly a domestic one, an important constraint is the expiration in 2000 of Article 8 of the WTO Agreement on Subsidies and Countervailing Measures (SCM) on non-actionable subsidies.

The SCM agreement allowed governments – under certain conditions – to support such activities as research conducted by firms or research establishments; assistance to firms needing to adapt existing facilities to new environmental requirements imposed by law and/or regulations; and assistance to disadvantaged regions.

These subsidies should remain non-actionable. This is a key issue to be negotiated by developing countries as part of the Implementation-related Issues and Concerns of the Doha Declaration.

Furthermore, while industrialized countries are pushing for further liberalization of trade, technology, and investment flows in international and regional negotiations, developing countries should argue that to take advantage of these flows, it is quite important to encourage international cooperation for building adequate policies and institutions in the host countries to meet environmental requirements, to adopt environmentally friendly technologies, and to foster endogenous innovation capabilities.

Canada, the United States, Japan and the European Union have accumulated a long historical experience in building such institutions and implementing these policies, and may be able to help developing countries to build ones that are similar, though also adapted to local realities. Although imported inputs do not substitute for the process of developing such institutions, they certainly may help.

The experience of Argentina with trade liberalization clearly show that, without building adequate institutions and public policies to deal with pervasive market failures – such as those related to environment and innovation issues – no sustainable development path is possible. Without these institutions, it may happen by chance that environmental conditions are not degraded, as documented in the case of soy or among large firms taking some environmental management initiatives. However, these are exceptions that are unlikely to be repeated.

References

Chudnovsky, D., F. Porta, A. López and M. Chidiak (1996), **Los Límites de la Apertura. Liberalización, Reestructuración Productiva y Medio Ambiente**, Alianza/CENIT, Buenos Aires.

Chudnovsky, D. and M. Chidiak (1996), "Competitividad y medio ambiente. Claros y oscuros en la industria argentina", **Boletín Informativo Techint**, N° 286, April-June.

Chudnovsky, D., A. López and V. Freylejer (1997), "La prevención de la contaminación en la gestión ambiental de la industria argentina", CENIT DT 24. A reduced version of this document entitled "The Diffusion of Pollution Prevention Measures in LDCs: Environmental Management in Argentine Industry" was published in R. Jenkins (ed), **Industry and Environment in Latin America**, Routledge, London, 2000.

Chudnovsky, D., Rubin S., Cap. E. and Trigo, E. (1999) "Comercio internacional y desarrollo sustentable. La expansión de las exportaciones argentinas en los años 1990 y sus consecuencias ambientales" CENIT DT 25, Buenos Aires.

Chudnovsky D. and López A. (2001) **La transnacionalización de la economía argentina**, Eudeba, Buenos Aires.

Conte Grand, M. (2000), "Public environmental expenditures in Argentina during the 90's", Documento de Trabajo Nº 169, Universidad del CEMA, October, Buenos Aires.

INDEC –Instituto Nacional de Estadística y Censos- (2003), *Segunda Encuesta Nacional de Innovación y Conducta Tecnológica de las Empresas Argentinas*, Estudios 38, INDEC, Buenos Aires.

Instituto Nacional de Tecnología Industrial (INTA) "El INTA ante la preocupación por la sustentabilidad de la producción agropecuaria argentina" December 2003

Fundación de Investigaciones Latinoamericanas -FIEL- (1996), **Medio Ambiente en la Argentina. Prioridades y Regulaciones,** Buenos Aires.

Hallak, J.C. & Levinsohn, J. (2004) "Fooling ourselves: Evaluating the globalization and growth debate" NBER WP 10244.

Trigo, E. Chudnovsky, D. Cap. E. & López A.(2002) **Los transgénicos en la agricultura argentina: una historia con final abierto**, Libros del Zorzal, Buenos Aires.

World Bank (1995), **Argentina. Managing Environmental Pollution: Issues and Options**, Environmental and Urban Development Division, Washington D.C.

Notes

[1] Unfortunately, there are no data specific to Argentina; we have thus used the World Bank methodology – itself based on the EPA Toxic Release Inventory and the US Manufacturers' Census – to define indicators for the evaluation of the potential environmental impact of Argentine manufactured exports with reference to their toxicity to humans.

[2] Most environmental regulations in Argentina are of the command and control type. There are rules for air and water that set environmental quality and emission standards, as well as legislation on hazardous waste. There are some "shy" cases of environmental taxes and subsidies (see Conte Grand, 2001), but they play only a marginal role in local environmental policy. No official deposit/refund scheme exists, and new policy instruments such as voluntary agreements to reduce pollution have not been introduced in Argentina.

[3] The ABCSD is an organization that gathers 38 business conglomerates – both local as well as foreign owned – that jointly represent 25% of the sales of the largest 1,000 Argentine firms. In turn, the sales of these 1,000 firms are about 50% of the domestic GDP.

[4] For SMEs, the EM indicator was built considering the following variables: knowledge of environmental regulations, targets for environmental performance and measures implemented to reduce pollution levels (such as end of pipe treatment, maintenance and operating practices, staff training, customer/supplier cooperation schemes, energy, water and input savings, product and/or process reformulation, raw material substitution, adoption of new clean technologies, and external recycling).

[5] This section is largely based on our book (Trigo, Chudnovsky, Cap & López, 2002), which analyzed this process through 2001.

[6] No-tillage maintains a permanent or semi-permanent organic soil cover (e.g. a growing crop or dead mulch) that protects the soil from sun, rain and wind and allows soil micro-organisms and fauna to take on the task of "tilling" and soil nutrient balancing – natural processes disturbed by mechanical tillage.

[7] Monsanto also produced the glyphosate in its Argentine manufacturing plant and filed an antidumping procedure against imports of that product from China. After a year and half process, in February 2004 the government decided against Monsanto's claim, a decision widely supported by the agriculture sector.

[8] The illegal seeds market (50% according to the company, in contrast to 18% of the seeds that are certified and 32% that are self produced by the farmers) has been the main reason that led Monsanto to close its soybean business in Argentina at the end of 2003, arguing that it was not profitable (La Nación, 21 December 2003). It is likely that the news of an adverse decision on glyphosate imports has also influenced the company. The Argentine affiliate will continue in the corn business.

[9] The Secretary of Agriculture has recently taken some initiatives to rebuild the INASE and to regulate the illegal seed market.