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Does Foreign Direct Investment Work For Sustainable Development?

A case study of the Brazilian pulp and paper industry

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Abstract

Foreign direct investment (FDI) is identified as a channel of development, promoting easy access to new technologies, increasing employment and income in the host economies. Transnational companies (TNCs) are increasing their share in the world production, generating and introducing advanced technologies. A new branch of the literature on FDI has been addressing its contribution to sustainable development in the host country. TNCs are supposed to transfer clean technologies and advanced environmental management systems, besides creating jobs, qualifying workers and so on. This article aims to contribute to this debate with a case study of the Brazilian pulp and paper industry, comparing the performance between transnational and national companies concerning sustainable development issues. This industry has been receiving increasing FDI since 2000. The study is based on secondary and primary data from nine big companies (five national and four TNCs), making use of indicators for the three dimensions of sustainable development – economic, social and environmental - to compare their performance. The main findings are: concerning economic performance, national and transnational companies are similar; national companies are ahead on the environmental performance; while the TNCs push for better social conditions, providing higher salaries and training for their workers. Based on these contradictory empirical evidences, we cannot conclude that FDI in the Brazilian pulp and paper industry works for sustainable development. Although national and TNCs have "good environmental practices", the increasing FDI in this industry is pushing for a higher environmental scale effect in a sector with a high potential for environmental damage.

Keywords: foreign direct investment, transnational corporations, Brazil, pulp and paper industry, environment, technology, sustainable development

Introduction

Transnational companies[1] have an important role to play in favor of the sustainable development pushing for environmentally friendly patterns of production especially in developing countries. This argument is based on the increasing participation of the TNCs in the global economy and their wide access to advanced technologies. TNCs are supposed to transfer advanced technologies to the host economies, contributing to increase the productivity, reducing the resources consumption and abating pollution.

According to the literature (Zarsky, 1999; UNCTAD, 2004; Araya, 2005) the FDI sustainable development impacts are very varied, i.e., case specific. That is why UNCTAD recommends a microeconomic approach based on sectoral studies as a proper methodology to assess the sustainable development impacts of FDI.

This study is based on the methodological approach suggested by UNCTAD (2004) and is focused on the Brazilian pulp and paper sector. The reasons for addressing this sector case are: the importance of the pulp and paper TNCs in the total FDI influx into Brazil in the last years; the high potential for environmental impacts of this sector; and the high share of this sector in the national production and exports. The fieldwork for this study involved a sample of nine companies, including five national and four foreign companies, seven sessions of pulp and paper sector labour unions and six regional sessions of the environmental control agency of the state of Sao Paulo (CETESB).

The paper is organized in three main sections, counting out the introduction and the conclusion. In the first section, departing from the literature the hypotheses to be considered for the fieldwork are identified. In the second section, a general picture of the participation of TNCs in the Brazilian pulp and paper sector is presented. The empirical research and findings are detailed in the third section.

1. Transnational Companies and Sustainable Development

Considering that there are many different views of the sustainable development concept and to clarify the methodological approach of this study, two preliminary comments are important: (i) the assessment of the sustainable development impacts of FDI considers the three analytical dimensions of the concept: economic, environmental and social; (ii) alternatively it is used here the term sustainability meaning a dynamic movement of the companies aiming to improve their economic efficiency, to reduce or eliminate their harmful environmental impacts and to improve their workers' livelihood conditions and the welfare of the communities around them.

In this section the main findings of the literature on FDI or TNC sustainable development impacts are identified and adopted as hypotheses for the fieldwork.

Concerning the economic dimension, the technology transfer is considered the main route of TNC impacts in the host economies. The TNC can transfer technology to the local firms due to technological spillover effects, i.e., the TNC technological knowledge can generate positive externalities to the technological learning of the local firms, workers and institutions. Technology spillovers can occur through several routes, including (Blomstrom & Kokko, 1996; Lall, 2000; Carvalho, 2005): copying of

[1] Considering the fact that the major players in FDI are TNC, these concepts are indistinctly mentioned here.

TNC technology and management practices by the local firms (the "contagion" effect); competitive pressure put by the TNC affiliates; TNC demand for local suppliers and sellers; P&D activities in the TNC affiliates; partnerships for P&D activities jointed by TNC affiliates, local firms and institutions; and transfer of skilled workers from the TNC affiliates to the local firms.

The extension of the spillover effects depends on several factors: the FDI objective (market-driven, resource-driven or technology-driven); the market destination of the TNC production (domestic or foreign markets); the technological profile of the sector FDI; the role of the TNC affiliate into the technological network of the TNC; the modality of the FDI; the technological gap between the TNC affiliates and the local firms; the domestic market structure; and the institutional context in the host country (Carvalho, 2005).

There are no conclusive empirical evidences concerning TNC environmental performance in developing countries, occurring different situations from TNC best technology and management practices to condemned actions as the transfer of dirtier activities indifferent to their harmful environmental impacts in the host country (Zarsky, 1999). So, the FDI environmental impacts tend to be context specific involving the interaction of several factors (Araya, 2005).

The recent researches on TNC environmental performance in developing countries focus on two microeconomic aspects: the TNC affiliate technological profile and the TNC corporate environmental management system. These aspects are determined by: the regulatory system in the TNC home country; the company specific characteristics; the market preferences for cleaner process and production methods (green markets); the industry specific characteristics that TNC operates; the informal regulatory forces as pressures from non-governmental organizations (NGOs) and the local community for a better environmental performance (Hansen, 1999; OECD, 2002). Moreover, it is necessary to consider the determinants mentioned above of technology spillover effects and their potential positive environmental impacts.

Finally, the FDI social impacts occur through direct and indirect jobs creation, human capital investments and social policies and programs. Moreover, TNCs tend to pay higher salaries compared to the salaries paid by the local firms (Almeida, 2003; Görg & Greenaway, 2003) and they are an important channel for human capital formation, mainly in developing countries with a deficient education system (Slaugther, 2002; Kapstein, 2002; Miyamoto, 2003). It is supposed that TNCs benefit from properties advantages to contract skilled workers and then achieving higher productivity and so affording higher salaries. It is also supposed that when transferring technology to the local firms, even though this transfer is restricted to the TNC affiliates, the TNC contributes to increase the demand for human capital and so for the local labor force to become more skilled. The TNC can also contribute to the local education system, for instance, through funding programs to the improvement of undergraduate and graduate courses, including equipments donations and grants to students and researchers.

Reviewing the literature on FDI and TNC sustainable development impacts, the following hypotheses are identified for conducting the work field:

- H.1: TNC affiliates generate positive technological externalities to the local firms in developing host countries;
- H.2: TNC affiliates adopt advanced environmental and technology management systems which assure them higher environmental control compared to the local firms in developing host countries;

- H.3: TNC affiliates pay higher salaries compared to the salaries paid by the local firms and they are a channel for developing human capital in developing host countries.

2. FDI in the Brazilian Pulp and Paper Sector

The picture of the Brazilian pulp and paper sector presented in this section is useful to qualify the preliminary hypotheses pointed out above based on the general review of the literature on FDI sustainable development impacts.

The Brazilian pulp and paper sector is presently composed by 220 firms widely located in 16 Brazilian states. To give an idea about this sector importance for the Brazilian economy, in 2005: this sector directly employed 108.000 workers; it produced 10.1 millions tons of pulp and 8.6 millions tons of paper, corresponding to 1.4% of the GDP. It is a sector characterized by high degree of international insertion with positive trade balance. The sector trade surplus was 2.5 billions in 2005 that is equivalent to 7% of the trade surplus accumulated in Brazil this year (Associação Brasileira de Papel e Celulose – BRACELPA, 2006a).

The presence of TNCs in the Brazilian pulp and paper sector has not been significant from a historical perspective. The FDI in this sector represented just 4.5% of the FDI accumulated in Brazil in 2000. But since 2000 the sector has been receiving increasing influx of FDI. On average foreign investment in the sector increased from US$ 8.6 millions per year between 1996-1999 to US$ 139.4 millions per year between 2000-2004.

This recent trend of the FDI into the Brazilian pulp and paper sector is probably connected to the general international trend for substituting long for short-fiber pulp that has been observed in the pulp industry. The international producers are searching for new mixtures of the two fibers aiming to increase the content of short-fiber pulp, which is the cheapest one. Consequently a strong increase in the international demand for short-fiber pulp is expected[2]. This trend implies that Brazil has become the preferential destination for the big pulp and paper TNCs investments, because this a water and land resources abundant country and, above all, because it is highly competitive in the production of short-fiber pulp controlling the eucalyptus[3] technology production and the paper production based on short-fiber pulp (O Papel, december./2005).

It is reasonable to suppose that TNCs affiliates operating in the Brazilian pulp and paper sector search for exploring the advantages of producing lower costs pulp to the domestic and international paper markets, but it is also expected that they make innovation efforts to absorb and to extend the short-fiber pulp technological knowledge based on eucalyptus. The participation of four important TNCs in two Research Consortiums on Eucalyptus in Brazil at the present time corroborates to this expectation. This implies a qualification on the first hypothesis (H.1): the technology spillover effects in the Brazilian pulp and paper industry could be occurring in both directions, i.e, from TNCs to local firms and from these last ones to the TNCs.

[2] See http://celuloseonline.com.br/Entrevista/Entrevista.asp?!ADEntrevista=223&iditem=. Access in July 2006.
[3] Eucalyptus is the most used timber specie for producing pulp and paper in Brazil.

The pulp and paper production is a high potential environmental activity, because it is a natural resources intensive production with high levels of timber, water and energy consumption, generating toxic chemical substances that can pollute water and causes an unpleasant smell. These are reasons why this sector has been constantly supervised by government authorities, environmental NGOs and consumers (Dalcomuni, 1997).

Since evidences of dioxins wastes that are cancerous substances were found in paper packages in the decade of 1980, the pulp and paper sector has been under increasing environmental pressure (Corazza, 1996).

According to available studies on the environmental performance of the Brazilian pulp and paper sector, the Brazilian firms reacted promptly to these increasing environmental requirements in the international markets enhancing their environmental management systems, for instance introducing the ISO[4] 14001 certificate, investing in pollution prevention technologies and resource consumption reduction technologies, resulting in environmental performance as good as or superior compared to the environmental performance of the firms located in countries with more stringent environmental regulations (Dalcomuni, 1997; Hilgemberg & Bacha, 2003). Concerning the forest resource, the Brazilian pulp and paper sector makes use of timber from cultivated forests according to advanced forest management practices and has been searching for globally recognized forest certifications as the FSC[5] (Dalcomuni, 1997; Marinho, 2000).

All these reported environmental improvements that have been introduced by the Brazilian pulp and paper sector are against the second hypothesis (H.2) indicated above based on the review of the general literature on the FDI sustainable development impacts. It means that H.2 has to be qualified here: the TNC affiliates in the Brazilian pulp and paper sector would hardly present a higher environmental management system compared to the local firms mainly the biggest and exporter ones.

The wide technological modernization occurred in the nineties in this sector has driven the demand for skilled workers to operate advanced equipments with microelectronic components and for administrative workers with higher education, versatility and learning capacity to implement more advanced management systems (Pereira, 2003; Daura, 2004). But the sector has been facing scarcity of skilled productive workers and to solve this problem the local firms have been investing in training and formal education for their employees (O Papel, february/2006).

According to the Social Responsible Report published by BRACELPA[6] (2003, 2004 and 2005), the TNC affiliates have also been promoting initiatives to educate, to train and to build professional capacities focusing their own employees and individuals from the community in their neighborhood. Therefore, the evidences show that both TNC affiliates and the local firms have an active role in promoting the human capital formation required in the sector.

A preliminary analysis of the TNCs role in the Brazilian pulp and paper sector based on the available studies and data points to their potential to contribute to the country sustainable development. They can cooperate to extend the technological competencies in pulp production owned by the local firms; they can keep or improve the sector environmental performance; and they can contribute to the human capital formation for the sector.

[4] International Standart Organization - ISO
[5] Forest Stewardship Council - FSC
[6] The Brazilian Association for Pulp and Paper.

3. Fieldwork: sample and methodology

The sample encompasses 9 companies, 7 labor unions and 6 units from the environmental agency from Sao Paulo state – CETESB. The inclusion of the environmental agency and labor unions aimed to get information from the two most affected parts by the industry activities, i.e., the workers and communities near pulp and paper mills. This fieldwork is an attempt of assessing the real extension of the efforts that have been made by foreign and local firms to reach the economic efficiency with social justice and ecological protection.

The sample companies have many mills spread on several Brazilian states. For practical reasons we tried to select only one CETESB unit and one labor union unit for each firm of the sample. Then, to associate a CETESB unit to a company plant, it was necessary that the company had at least one plant in São Paulo. It was not possible in three cases and that is why the sample includes just 6 CETESB units in place of 9. On the situations where firms had more than one plant in Sao Paulo, we selected integrated plants, it means plants that produce paper and pulp. This option is justified because pulp production generates much more emissions than the paper production.

Concerning the labor unions selection, it was based on the indications from the National Labor Union of Workers in Pulp and Paper Industry (SINAP). In this case as well, we chose, when possible, labor unions that were linked to integrated plants localized in Sao Paulo. It was not possible to count on the participation of two unions, so this sample has just 7 labor unions that are spread on 3 different Brazilian states – 5 in Sao Paulo, 1 in Espirito Santo and 1 in Parana.

Nine companies of the sample represent a set of 45 mills that are capable to produce 9.1 millions tons of pulp per year and 5.1 millions tons of paper per year. In 2004 these companies were responsible for 81.4% of pulp production and 52.3% of paper production. Only 2 companies are not integrated (see table 1).

The TNCs are totally foreign-owned, what makes easy the comparison between them and the Brazilian companies. According to BRACELPA, in 2004 the four subsidiaries from the sample represented 98.4% of the foreign production of pulp in Brazil and 46.2% of paper production.

To elaborate the indicators of technological, environmental and social performance, the data were collected through interviews, questionnaires sent by e-mail and based on the analysis of companies' reports for years 2002, 2003 and 2004. We expect that including data based on three years, we can count on a more trustful average. The data collecting was done between September 2005 and June 2006; in cases where data were not available for one of these years, we considered the 2006 data.

Table 1 –Companies Sample

Companies	Products	Participation in Brazilian production in 2004		Production capacity in ton/year in 2005		Number of plants in 2005	Production percentage yearly exported	
		Pulp	Paper	Pulp	Paper		Pulp	Paper
Brazilian								
Aracruz	Pulp	25.96%	-	3,000,000	40,000	3	97%	-
Klabin	Pulp, eucalyptus and pinus logs, improved seeds of eucalyptus and pinus, packaging paper, corrugated box, boards, kraft paper for sacks and envelops, sacks	11.87%	17.19%	1,200,000	1,500,000	18	-	55.7%
Ripasa	Pulp, industrial base paper, cut size, coated and uncoated paper and paperboard	4.87%	6.17%	570,000	380,000	4	-	46.7%
Suzano Bahia Sul	Pulp, cut size, coated and uncoated paper and paperboard	11.47%	9.32%	1,290,000	1,350,000	3	36.1%	40%
Votorantim	Pulp, cut size, coated and uncoated paper and chemical papers	14%	7.07%	1,300,000	635,000	4	44.3%	28.7%
Total 1	**-**	**68.17%**	**39.75%**	**7,360,000**	**3,905,000**	**32**	**-**	**-**
Foreign								
Cenibra (Japan)	Pulp	9.51%	-	940,000	-	1	95%	-
Internacional Paper (EUA)	Pulp, eucalyptus and Pinus chips, improved wood of pinus, coated and uncoated paper.	4.68%	7.38%	450,000*	600,000	2	n.d.	n.d.
Norske Skog (Denmark)	Newsprint paper	1.77%	2.08%	170,000*	185,000	1	-	1.33%
Rigesa (EUA	Packaging paper and corrugated paperboard packages	2.26%	3.73%	220,000*	320,000*	9	n.d.	n.d.
Total 2	**-**	**18.22%**	**13.19%**	**1,780,000**	**1,105,000**	**13**	**-**	**-**
Total 1+ 2	**-**	**86.39%**	**52.94%**	**9,140,000**	**5,101,000**	**45**	**-**	**-**

Source: our elaboration based on the work field, reports from companies for years 2002, 2003 and 2004 and on Bracelpa (2005).
* Data elaborated by ourselves based on information on companies production in 2003 and 2004 from Bracelpa (2005)

3.1 TNCs and Technological Spillovers: empirical findings

The spillovers indicators can be divided in two groups. The purpose of the first group is to measure the extension of internal R&D efforts of the companies and is presented in table 2.

Table 2 – Technological spillovers: innovation efforts

Companies	Does the company have a R&D department?	R&D participation in sales	Workforce percentage occupied in R&D	Education level of employees occupied in R&D
Brazilian				
Aracruz	Yes	0.56%	3.32%	Graduates: 10 Masters and doctors: 12
Klabin	Yes	0.09%	0.30%	Graduates: 19 Masters and doctors: 6
Ripasa	Yes	0.12%	0.40%	Graduates: 4 Masters and doctors: 7
Suzano Bahia Sul	Yes	0.49%	0.79%	Graduates: 8 Masters and doctors: 7
Votorantim	Yes	0.13%	0.83%	Graduates: 13** Masters and doctors: 9
Mean	-	**0.28%**	**1.13%**	**Graduates: 10.8** **Masters and doctors: 7.40** **Number of graduates and pos-graduates by company: 18.20**
Foreign				
Cenibra	Yes	-	1.07%***	Graduates: 14 Masters and doctors: 6
Internacional Paper	Yes	-	1.56%	Graduates: 40 Masters and doctors: 4
Norske Skog	Yes	0.40%	2.54%	Graduates: 3 Masters and doctors: 2
Rigesa	Yes	-	-	Graduates: 13** Masters and doctors: 9
Mean	-	**0.40%**	**1.72%**	**Graduates: 19** **Masters and doctors: 3.3** **Number of graduates and pos-graduates by company: 22.30**

Source: our elaboration based on the fieldwork.
*Average from years 2002, 2003 and 2004, excepting in the following cases: Klabin and Norske Skog only have data for years 2003 and 2004, Suzano for 2004 and 2005 and Votorantim for 2001, 2002 and 2003.
** This data includes just employees dedicated to the paper R&D, it does not cover scientists occupied in pulp R&D and trainees. So this value is underestimated.
*** This data includes just graduate and post-graduate workers and it does not cover trainees. So this value is underestimated as well.

The second group investigates the existence of forward linkages and it is presented in tables 3 and 4.[7] Table 2 shows that all local firms and TNCs have R&D departments. However, while the local firms occupy only 1.13% of their workforce in this kind of activity, foreign subsidiaries occupy 1.72%. It is expressed as well in the number of graduates and pos-graduates occupied by each group of firms: the national group has 18.20 employees against 22.3 of the foreign group. On the other hand, domestic companies employ a superior number of masters and doctors, 7.40 against 3.30 of TNCs what indicates that local firms have more qualified researchers.

Domestic firms spent around 0.28% of their sales in R&D between 2002 and 2004. Norske Skog, the only TNC from which was possible to get this information, spent more: 0.40%. It is important to note that the Norske Skog R&D expenditure is higher than Klabin and Ripasa R&D expenditure which are local firms that have a productive capacity higher than Norske Skog.

According to UNCTAD (2005), among TNCs, the European companies have the greatest R&D investments in foreign affiliates. In second position are the American TNCs which are followed by Japanese and Korean companies. If we consider the size of the R&D department as an indicator of innovation efforts, we conclude that the UNCTAD´s evidences are corroborated here as well. The TNC that has the biggest R&D department is Norske Skig (European), followed by International Paper (American) and in the last position is Cenibra (Japanese).

The only two foreign subsidiaries that reported their position in terms of the main process and product technologies – Norske Skog and International Paper – informed that they have just used and adapted the technologies developed in their parent companies or in other company's affiliates.

Thus the evidences brought by the empirical study on the innovation efforts are contradictory. On the other hand, we can explain it through the hypothesis that the TNCs locate in Brazil just the initial phases of their R&D projects, it means just the simplest parts of the projects which are further transferred to the parent company or others company's subsidiaries. Since the most complex parts of the R&D projects are not made in Brazil, despite of having bigger R&D departments, TNCs do not need a high qualified R&D team and do not set up deep links with the Brazilian universities and research institutions. The TNCs participation in national research groups on eucalyptus may be an attempt of absorbing the Brazilian technology on reforestation that can be transferred to the parent company.

The forward linkages indicators presented in table 3 show that 41.7% of capital goods demanded by the sample is produced in Brazil by foreign companies. Only 25.4% of capital goods are made in the country by domestic forms. It reveals the weakness of Brazilian capital goods producers that serve the pulp and paper industry. Domestic firms demand around 57.5% of machines and equipment in Brazil, while foreign firms demand 66.7%.

[7] It is necessary to note that these indicators can be under or overestimated considering that from 4 TNCs only 3 and for some variables only 2 answered the questions related to these indicators.

On the other hand, table 3 indicates that the production of raw material is almost totally made in Brazil, around 96.8% from which 57.4% are supplied by Brazilian firms and 39.4% by TNCs. Local firms from the sample buy 46.5% of their raw material from Brazilian suppliers and 48.7% from foreign suppliers; while the TNCs buy 68.5% from local and 30% from foreign raw material suppliers. Thus, regarding raw materials, TNCs buy more from Brazilian suppliers than the local firms.

Table 4 presents the channels for supplier's development that have been used by the companies from the sample. Klabin and Ripasa, two Brazilian companies, are the only firms that do not adopt any policy for supplier's development. The most used channel is technical assistance to introduce quality control and other management systems. All TNCs adopt at least one supplier development channel that means these companies have a consistent policy in this field. Besides giving assistance for management systems, Rigesa offers training to suppliers and Cenibra develops suppliers to produce parts and components for import substitution. Among domestic firms, Votorantim and Suzano have been transferring production technologies to their suppliers. Thus, the two groups – TNCs and local firms – have been investing in supplier's development.

Table 3 – Technological spillovers: supply nationality

Companies	Made in Brazil by Brazilian suppliers		Made in Brazil by foreign suppliers		Imports	
	Capital goods	Row material	Capital goods	Row material	Capital goods	Row material
Brazilian						
Aracruz	50%	80%	40%	10%	10%	10%
Klabin	10%	46%	70%	50%	20%	4%
Ripasa	30%	60%	30%	40%	40%	0%
Suzano Bahia Sul	-	-	-	-	-	-
Votorantim	40%	0%	0%	95%	60%	5%
Mean	**32.50**	**46.50**	**35.0**	**48.75**	**32.50**	**4.75**
Foreign						
Cenibra	-	-	-	-	-	-
International Paper	30%	25%	60%	70%	10%	5%
Norske Skog	15%	100%	75%	0%	10%	0%
Rigesa	10%	80%	10%	20%	80%	0%
Mean	**18.33%**	**68.33%**	**48.33%**	**30%**	**33.33%**	**1.67%**
Sample Mean	**25.42%**	**57.42%**	**41.67%**	**39.38%**	**32.92%**	**3.21%**

Source: our elaboration based on the fieldwork.

Table 4 – Technological spillovers: supplier development strategy

Companies	Has the company contributed to the development of the Brazilian supplier chain?	Suppliers development channels
Brazilian		
Aracruz	Yes	Suppliers training; technical assistance to implant quality control and other management systems.
Klabin	No	None
Ripasa	No	None
Suzano Bahia Sul	Yes	Transfers of production technologies.
Votorantim	Yes	Transfers of production technologies.
Foreign		
Cenibra	Yes	Technical assistance to implant quality control and other management systems; suppliers development to produce parts and components to use in imported equipment.
International Paper	Yes	technical assistance to implant quality control and other management systems.
Norske Skog	Yes	technical assistance to implant quality control and other management systems.
Rigesa	Yes	Suppliers training; technical assistance to implant quality control and other management systems.

Source: our elaboration based on the fieldwork.

According to the empirical findings, the hypothesis H.1 is valid for some spillovers channels that are the forward linkages and the demonstration effect, being indefinite for the indicator of innovation efforts. This last indicator may be revealing the presence of reverse technological spillovers, it means technology transfer from Brazilian companies to the TNCs. In this sense, TNCs may be just absorbing the local knowledge based on reforestation technology of the eucalyptus and on production methods of short-fiber pulp and paper. Thus TNCs do not intend to increase this knowledge base by generating innovations in their Brazilian subsidiaries.

3.2 TNCs and Environment: empirical findings

This section is aimed to investigate the level of environment control in the pulp and paper sector in Brazil, analyzing the emission indicators and the environmental management systems of the sample companies. These indicators do not cover the forest phase of the pulp and paper production process, i.e, they include just the industrial phase.

Table 5 presents an indicator, based on Almeida (2001), that classifies the environmental management system of each company in three categories: initial, intermediate and advanced:

- I- Initial level: pollution control via end-of-pipe technologies i.e. pollution is not controlled at the source, use of technologies which just reduce the pollution effects that have already been generated;

- II - Intermediary level: includes efforts to prevent pollution; the company intends to improve continuously its environment performance, reducing or eliminating wastes and effluents; introducing systems to reuse wastes and effluents to save water, energy, raw material and so on;

- III - Advanced level: besides including the management systems to control the environmental impacts of the production process, it includes all the impacts at any point of the product life cycle as well. The environmental impacts are controlled from the selection of raw materials to the distribution and the final disposal of the product by consumers. The purpose is to recover, reuse and recycle the materials used in production process and the product after its consumption. In the case of pulp and paper industry, the integrated companies are much more worried with the environmental management of the product than those companies that just produce pulp, because it is an intermediate product.

Companies can present characteristics from more than one category of management system, i.e., they can be in transit from a level to another:

I $\Rightarrow$ II - moving from the initial level to the intermediary;
II $\Rightarrow$ III - moving from the intermediary level to the advanced.

This indicator was elaborated based on data from CETESB units and from the companies and it intends to investigate the interaction between the environmental departments and the other departments of the firms, if companies have established objectives and goals to environmental control, which are the measures already adopted in this field, and how firms have actualized their knowledge on environmental regulations. The indicator shows if companies have an active environmental management and if they have a preventive or corrective approach to environmental impacts. In this sense, it is important the ISO 14001 certificate, although this certification does not determine performance goals, it expresses that the company makes at least some effort to organize their environmental management.

According to table 5, all the companies have at least one plant certified with ISO 14001. There are more Brazilian firms plants certified with ISO 14001 than TNCs plants. Regarding to environmental investments, from the nine companies, seven counted their environmental investments between 2002 and 2003, what shows that they give some importance to environmental management systems. The wide International Paper's expenses with environmental investments are due to the recent modernization of the environmental equipment in one of its plants – Mogi Guaçu in Sao Paulo. The indicator shows that from five local firms, three are moving to the advanced level of environmental management

system, while only one TNC is in a transitional period form the second to the third level. The other companies are in the intermediate level.

Table 6 presents the total emissions of the two groups: Brazilian and foreign companies. This set of indicators analyses the efficiency in water consumption, the contamination level of the effluents and the emissions level of malodorous gases that are linked to the pulp production. We tried to choose the indicators that better express the environmental problems of the pulp and paper industry in the industrial phase such as: the high demand of water and energy, the generation of toxic effluents and the malodorous smell. The indicators[8] BDO5, TSS and AOX measure the effluents quality and the TRS is responsible for the sulfur compounds that cause the malodorous smell.

Table 5 – Environmental management system: industrial phase

Companies	Certification		Participation of environmental investments in total investments*	Environmental management level
	Certificate	Certified plants		
Brazilian				
Aracruz	ISO 14001	2 from 2	1.38%	II ⇒ III
Klabin	ISO 14001	4 from 18	11.73%	II ⇒ III
Ripasa	ISO 14001	1 from 4	4%	II
Suzano Bahia Sul	ISO 14001	1 from 3	7.18%	II ⇒ III
Votorantim	ISO 14001	2 from 4	9.77%	II
Mean	**-**	**32.26%**	**6.81%**	**-**
Foreign				
Cenibra	ISO 14001	1 from 1	2.79%	II ⇒ III
Internacional Paper	ISO 14001	1 from 2	34%	II
Norske Skog	ISO 14001	1 from 1	**	II
Rigesa	ISO 14001	1 from 9	**	II
Mean	**-**	**30.77%**	**18.39%**	**-**

Source: our elaboration based on the fieldwork and companies's environmental reports from years 2002, 2003 and 2004.
*Average from years 2002, 2003 and 2004, excepting Klabin and Aracruz that present data for years 2003, 2004 and 2005 and Cenibra which data are available only for 2005.
** The companies do not have this value calculated.

All plants, excepting Aracruz and Cenibra, are integrated, what favors the comparison between the two groups of companies. For the six parameters, local firms present an average lower than TNCs in four that are: water consumption, BDO5, AOX and TSS. To obtain a trustful average given that these companies have different production processes that may

[8] BDO – Biochemical Oxygen demand; TSS – Total Suspended Solids; AOX – Absorbable Organo-Halogens; and TRS – Total Reduced Sulfur.

affect the performance on the emissions indicators, we decided to compare the indicators for each product segment of each company.

Cenibra and Aracruz are both not integrated companies, they just produce short-lived pulp from eucalyptus, so they have similar production processes. Aracruz presents an average of emissions indicators lower than Cenibra in all parameters.

Votorantim, Suzano Bahia Sul, Ripasa and International paper are integrated producers of the writing and printing paper. By calculating the average of the three Brazilian companies and comparing with the international Paper performance, the Brazilian group reaches an average lower than foreign subsidiary in five of the six parameters. The values reached by local firms are the following: water consumption – 40.45 m3/ton; effluents volume - 36.98 m3/ton, BDO5 – 0.64 kg/ton; AOX – 0.13 kg/ton; TSS – 1.02 kg/ton; and TRS – 0.05 kg/ton.

Table 6 – Emission indicators: industrial phase

Companies	Water consumption(m3/ton)	Effluents volume (m3/ton)	BDO5 (kg/ton)	AOX (kg/ton)	TSS (kg/ton)	TRS (kg/ton)
Brazilian						
Aracruz *	37.30	35.20	1.46	0.11	1.28	-
Klabin	40	37	1	-	-	0.29
Ripasa	35	30	0.40	0.20	1.50	0.03
Suzano Bahia Sul	42	42	0.56	0.10	0.54	-
Votorantim**	44.35	38.95	0.95	0.095	-	0.06
Mean	**39.73**	**36.63**	**0.87**	**0.13**	**1.11**	**0.13**
Foreign						
Cenibra	52.8	-	1.60	0.13	1.40	0.09
Internacional Paper***	55.9	55.3	1.90	0.50	3.60	0.02
Norske Skog	29.3	23.7	0.34	-	0.07	-
Rigesa	48.4	25.9	0.80	-	3.20	-
Mean	**46.60**	**34.97**	**1.16**	**0.32**	**2.07**	**0.06**

Source: our elaboration based on the fieldwork and companies's environmental reports from years 2004 and 2005.
* concerning just the Barra do Riacho – Espírito Santo – Brazil.
** This average is based on data from the Luiz Antônio and Jacareí plants – São Paulo – Brazil.
*** Data cover just the Mogi Guaçu plant – São Paulo – Brazil.

Klabin and Rigesa produce mainly packaging papers and corrugated paperboard packages. Considering the three comparable parameters – water consumption, effluents volume and DBO5 – Rigesa presents lower values than Klabin in two parameters. It is not possible to compare Norske Skog with any other company because it is the only national producer of newsprint paper. However, this TNC is the company with the lowest indicators, i.e, presents the best performance in all indicators.

Thus, the indicator of environmental management systems shows that all companies are at least in the intermediary level, with the domestic firms leading the transition from the intermediary level to the advanced level. Brazilian companies presented a better performance concerning the emission indicators as well. Local firms, not the TNCs, lead the

efforts to improve the industry environmental performance. So H.2 is not corroborated with the empirical findings here for the Brazilian pulp and paper industry.

This conclusion confirms the suspicion that TNCs hardly would have an environmental control superior than Brazilian companies in this sector. The explanation is due to the fact that Brazilian producers reacted very well to the increasing of environmental demands in the end of 1980's, getting to keep or augment their market share in countries with strong environmental regulation and demanding costumers. Brazilians producers, mainly in the pulp segment, export big shares of their production, so they are exposed to the international competition, what forced them to invest in environmental certification of the forest and industrial phase, to modernize equipment for controlling and preventing pollution and to adopt measures to reduce the resources consumption.

Although TNCs are not ahead of Brazilian companies in terms of environmental efficiency, according to data from CETESB and foreign subsidiaries, these companies do not use Brazil as a "pollution haven". According to CETESB, the two TNCs that have mills in Sao Paulo present environmental performance superior than what is required by the Brazilian regulation. The factors that can explain this performance are: TNCs are induced to have a solid and efficient environmental management system because they operate in a sector with a high pollution potential that is under pressure from authorities, customers, and environmentalist groups; Brazilian companies have a high environmental performance, so the TNCs are induced to perform as good as the local ones to be competitive in the local market; Brazilian regulation is strong; company specific characteristics as the their origins in countries with strong regulation and demanding consumers.

3.3 TNCs and social conditions: empirical findings

Based on data from the seven labor unions of the sample, it is possible to conclude that local firms and foreign subsidiaries have invested in operational training and formal education. However, TNCs's employees appear to be more satisfied with their jobs than the Brazilian companies's workers. All the labor unions linked to the TNCs consider these companies' human resources policies good, while only one from four unions linked to domestic companies presents the same opinion. Human resources policy is considered here as the salaries policy, the human capital development strategy and how the company approaches its workforce. A common complaint of the labor unions are that workers had been under too much pressure to increase the productivity, so they can not take advantages from the opportunities offered by the companies to increase their educational level because they feel a mental and physical fatigue.

Table 7 presents the quantitative indicators of human capital efforts and the wages expenses of the companies from the sample. Once more it is necessary to note that these indicators may be underestimated or overestimated because just two from four companies answered the questions related to the social indicators.
TNCs appear to pay wages and benefits 19.5% higher than what is paid by the Brazilian companies. While TNCs spend yearly R$ 48,942.23 per worker, local firms spend just R$ 40,959.39. Although Rigesa has not reported their wages and benefits expenses, the labor

union linked to this TNC informed that it has paid wages higher than the average salary paid in the pulp and paper industry. Thus even though the Brazilian firms are big size companies, we found a positive differential in term of wages and benefits in favour of TNCs.

The quantity indicators on human capital formation are also in favor of the TNCs. The foreign affiliates spent around R$ 1,141.46 per worker yearly between 2002 and 2004, while domestic firms spent R$ 893.09. In this same period TNCs trained their workforce more than local firms: 63.7 annual hours per worker against 53.4 annual hours in the Brazilian companies. This conclusion reinforces the results found in the literature and so confirms the hypothesis H.3 for the Brazilian pulp and paper industry.

On the expenses with social actions, there is a clear superiority of the local firms. These companies spent on average 0.19% of their sales in social actions and the TNCs spent only 0.04%. In other words, despite of TNCs contribution to the industry efforts in human capital formation, domestic firms are much more interested in the development and welfare of external communities. From the seven labor unions consulted, just three consider the social actions from companies satisfactory. The majority believe that these investments are quite small if compared to the companies' sales and their environmental impacts on the communities in the plants neighborhood.

Table 7 – Social expenditures and human development: average from years 2002, 2003 and 2004

Companies	Annual expenditures in wages and benefits per worker	Annual expenditure in human capital formation per worker	Number of annual hours of training per worker*	Participation of social expenditures in sales
Brazilian				
Aracruz	59,063.49	1,322.08	43	0.40%
Klabin	35,829.69	274,77**	-	0.0008%
Ripasa	34,387.38	568.09	-	0.11%
Suzano Bahia Sul	25,638.64	868.24	64	0.33%
Votorantim	49,877.75	1,432.25	53.20	0.11%
Mean	**40,959.39**	**893.09**	**53.40**	**0.19%**
Foreign				
Cenibra	40,242.42	876.29	4.47	0.07%***
Internacional Paper	-	-	140.50	-
Norske Skog	57,642.03	1,406.63	46	0.01%
Rigesa	-	-	-	-.
Mean	**48,942.23**	**1,141.46**	**63.70**	**0.04%**

Source: our elaboration based on fieldwork and on the companies's annual reports from 2002, 2003 and 2004.
* The following companies just have data for some years: Aracruz – 2003, 2004 and 2005; Suzano Bahia Sul – 2003 and 2005; Votorantim – 2004 and 2005; Cenibra – 2004; International Paper – 2003 and 2004; Norske Skog – 2004 and 2005.
** Average from years 2003 and 2004.
*** Average from years 2003, 2004 and 2005.

Conclusion

Given the controversies on the sustainable development impacts of FDI in the host economies, this study intended to offer evidences from the Brazilian pulp and paper sector. In this case and considering the aggregated parameters of assessment, the main conclusion is that TNCs and local firms' contributions to the Brazilian sustainable development tend to be similar.

We can conclude that TNCs have contributed to the Brazilian pulp and paper industry sustainability in many ways. On the economic dimension, they have established important links with the local supplier chain and introduced efficient and technologically advanced plants. On the environmental dimension, although foreign affiliates do not lead the improvement of environmental control, they at least have adopted measures that minimize negative impacts, contributing to the high pattern of environmental performance of the industry. On the social aspect, they have developed the human capital demanded by the industry and paid higher wages. However, we identified three factors that appear to be limiting this contribution.

In first place, we observed a potential for reverse technological spillovers in the Brazilian pulp and paper industry. There are evidences that TNCs are just absorbing the national knowledge base on the eucalyptus culture and on the production process with short-fiber and they are not widening this knowledge base by generating innovations through their affiliates installed in Brazil. The country has been accumulating valuable technological competence on the short-fiber pulp segment what gives to the country the position of the biggest international producer of this good. If we added to that the expected growth of short-fiber pulp comsuption worldwide, Brazil becomes a preferential location for TNCs.

Second, it is worth to note, in accordance to the ecological economics thinking, that the efforts of local and foreign companies in the pulp and paper sector to achieve higher environmental efficiency may not be enough to fully cope with the environmental impacts of this sector. This sector has been growing in Brazil during more than two decades and it can generate environmental pressures due to the "scale effect", i.e., the industry expansion augments the needs of water, energy, wood and so on, what reduce the environment capacity to attend these demands. Besides, this is an activity with high pollution potential. So the installation of new foreign plants added to Brazilians producers' expansion can accelerate the environmental degradation. This is one of the potential negative environmental impacts of the FDI growth in this industry.

Finally, the empirical study pointed out the low social investments that TNCs have done in Brazil if compared to national companies. Foreign subsidiaries could help much more Brazilian development by increasing their investments in formal education of poor communities.

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