The environmental practices and performance of transnational corporations*

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This article presents a framework that relates financial, regulatory and organizational variables to the environmental practices and performances of transnational corporations. The framework is tested empirically using multiple regression analysis. The results suggest that organizational and regulatory factors influence environmental practices, but that the relationship between practice and performance is weak. No relationship is found between environmental performance and subsequent financial performance.

Despite the rapidly growing literature on environmental management, there has been little systematic research into the international dimensions of this subject. There are several reasons for studying corporate environmental performance in the international context. First, transnational corporations (TNCs) tend to be very large producers of pollution due to their size and predominance in pollution-intensive industries such as chemicals, petroleum and mineral extraction and processing. Second, because of their relatively high expenditures on research and development and their international coordination of manufacturing, TNCs can potentially create and/or transfer pollution-reducing technologies to their globally dispersed operations. Finally, the behaviour of TNCs is expected to differ from that of purely national firms. Transnational corporations are faced with regulations and enforcement practices that vary across countries and have to make choices between a standardized or differentiated response (and, in the case of the former, which standards to follow). Moreover, TNCs are subject to international conventions, but are arguably more powerful and less subject to control by national governments and agencies than purely national firms (Bruno, 1992; Ives, 1986; Rich, 1990).

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Background

According to much of the current literature on environmental management, large TNCs are in the forefront of efforts to improve their environmental practices and performances, spurred by a growing appreciation that being "green" is good for business (Greeno and Robinson, 1992; Hunt and Auster, 1990; Schmidheiny, 1992; Smart, 1992). According to Johan Schot and Kurt Fischer (1993), by the end of the 1980s most large firms had formal written environmental policy statements, with the majority claiming that they go "beyond compliance".

There is some evidence that corporate environmental practice is changing. A number of studies have documented that more companies are appointing senior officers with sole responsibility for the environment, health and safety (Dillon and Fischer, 1992; Koza, 1989; Rappaport and Flaherty, 1992; UN-TCMD, 1993). These studies have also showed that more companies are developing environmental policies to assess the impact of their operations, to improve procedures to cope with a crisis and to search for cost-effective investments that would improve environmental performance. Case studies and anecdotal evidence also suggest that some companies are applying techniques related to "lean production" in an attempt to cut pollution at its source, rather than install expensive "end-of-the-pipe" equipment to clean up the waste stream (Bringer and Benforado, 1994; Price, 1990). Frequently cited examples include Chevron's SMART programme (Save Money and Reduce Toxics) and 3M's 3P programme (Pollution Prevention Pays) (Smart, 1992).

Despite the evidence that some TNCs are becoming more responsive to environmental issues, there are few systematic data on improved environmental *performance*, measured in terms such as toxic emissions. Rogene Buchholz (1993, p. 378), after describing 3M's far reaching environmental efforts, admitted that "the best light we can put on the programme is that the company reports its waste streams today are growing at a lesser rate than their manufacturing output". Critics of the environmental performance of TNCs (e.g., Dadd and Carothers, 1991; Doyle, 1991; Shiva, 1993) argued that policies and promises are cheap; investments to reduce pollution are often expensive and unprofitable, while most of the benefits are externalities which cannot be captured by private firms. According to Buchholz (1993, p. 55), "Being socially responsible costs money. Pollution control equipment is expensive to buy and operate . . . These efforts cut into profits, and in a competitive system, companies that go very far in this direction will simply

price themselves out of the market''. This view is echoed by Noah Walley and Bradley Whitehead (1994).

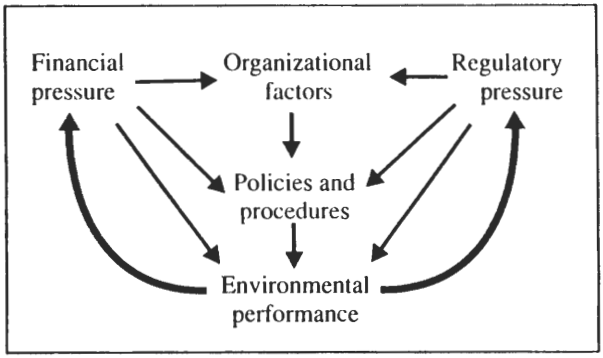
The purpose of this article is to go beyond descriptions of corporate environmental practices in order to analyse the factors that influence both practice and performance. To this end, the article develops a conceptual framework that relates financial, regulatory and organizational variables to environmental practice and performance. The framework is then tested empirically using data drawn from the United Nations Benchmark Corporate Environmental Survey (UN-TCMD, 1993) and other sources. In contrast to earlier research, the methodology makes a clear distinction between environmental practice, in terms of policies and procedures, and environmental performance. It also overcomes the problem of possible reverse causation that exists with prior research on the relationship between financial factors and environmental practice and performance, such as that conducted by Michael Russo and Paul Fouts (1994). The results suggest that organizational and regulatory factors do influence environmental practice and performance, but that there is surprisingly little relationship between practice and performance. Most striking is that large companies, which are the most progressive in terms of environmental policies and procedures, are found to have poorer environmental performances in terms of reductions in hazardous emissions.

Determinants of environmental practices and performance

Environmental practices and performance could be influenced potentially by a wide range of stakeholders, including employees, suppliers and customers. The focus of this article is on economic, regulatory and organizational factors; prior research suggests the importance of these influences, and the research builds on a survey that provides relevant data. Figure 1 presents a model that shows the relationships expected to exist among the variables.

This framework makes a clear distinction between environmental *practices* and *performance*. Environmental practices refer to policies and procedures, for example, for monitoring discharges or for periodic environmental audits. Environmental performance is defined here in terms of emissions of hazardous substances into air, land and water. Stronger environmental practices, meaning more comprehensive and stringent policies and procedures, are expected to lead to better environmental performances; it is also possible

Figure 1. A model of environmental practice and performance



that environmental performance is directly affected by regulatory, financial and organizational variables. For example, decisions to invest in pollution-reducing technologies may not show up in environmental policies and procedures.

Firms that are constrained in terms of profitability or liquidity are expected to pursue less aggressive environmental policies and procedures and curtail investments in pollution reduction. Although environmental efforts can have positive financial payoffs, there is no evidence that poor financial performance stimulates better environmental practices and performance. Indeed, case-study evidence from Roger Kasperson (1988) suggests that financial factors do constrain environmental efforts, and that firms assume that environmental efforts impose at least a short-term net cost on the firm.

Pressure from regulatory agencies and the public is, according to existing research, one of the most powerful drivers of corporate efforts to reduce pollution (Ashford, 1993; Dillon and Fischer, 1992; Kasperson, 1988; Rappaport and Flaherty, 1992; Steger, 1993; Williams *et al.*, 1993). Several organizational variables are expected to mediate this pressure on the firm. Firms are likely to experience greater external pressure when they have a high public profile, which is likely to be associated with being large (Williams *et al.*, 1993), transnational or having a poor environmental record. To some extent, firms might be able to resist pressure and bargain with regulatory agencies to avoid or delay measures perceived as costly. The factors that are likely to increase a company's bargaining power relative to regulatory

agencies are similar to those that expose the company to pressure in the first place. Larger firms have more resources to engage in corporate political activity, and companies that are more transnational in scope might be in a better position to threaten to move production elsewhere.

The extent of managerial commitment and motivation is another organizational variable that will influence environmental practices and performance (Cebon, 1993; Dillon and Fischer,1992; Rappaport and Flaherty, 1992). Appropriate motivation could take the form of including environmental issues in strategic planning or in performance evaluation and incentive systems; this would help to communicate the message to managers that the company is not just paying lip-service to environmental goals. These organizational influences are likely to vary according to norms and standard practices in both host and home countries.

The relationship between environmental efforts and subsequent financial performance is subject to considerable controversy. The relationship is important because it serves as a potentially powerful feedback loop in the model. If the impact is positive, one might expect this to create a virtuous circle in which companies reap the benefits of aggressive environmental programmes and are then in a better financial position to invest even more in environmentally safer products and low-pollution technologies. On the other hand, a negative link would soon discipline firms that invest in environmental products and processes. For, if companies could not capture sufficient private benefits to warrant high environmental expenditures, they might be expected to move towards non-compliance, benign neglect or even aggressive anti-environmentalism.

The evidence is very mixed on this subject. Michael Russo and Paul Fouts (1994), in a statistical study of large United States corporations, found a strong positive relationship between return on assets and ratings of environmental performance. They could not, however, rule out reverse causation; in other words, more profitable firms might devote more resources to environmental efforts. Wayne Gray and Ronald Shadbegian (1993), in a study of nearly 300 plants, found that efforts to comply with environmental regulations had a large negative impact on productivity and market growth. Some limited case-study evidence suggests that, while there are many opportunities for pollution-reducing investments, they are not consistently profitable (Cebon, 1993) and existing investment appraisal techniques do not reliably identify those investments that are (Rappaport and Flaherty, 1992; White, Becker, and Savage, 1993; White, 1993). Hans Dielman and Sybren de Hoo (1993) found that substantial reductions in pollution were not very costly and

occasionally yielded big savings. The model indicates a second feedback loop, between environmental performance and regulatory pressure: if regulatory agencies pursue firms with the worst environmental records, then those firms that are successful in improving their environmental performance are likely to feel less regulatory pressure in the future. Unless the environmental improvement process has been institutionalized, this could weaken significantly future environmental efforts. On the other hand, it is possible that firms that aggressively pursue environmental goals will generate higher expectations and be subject to closer scrutiny by the public and regulatory agencies. Mitchell Koza (1989) supported this latter argument with case evidence on European firms.

A number of hypotheses derived from the above model and discussion can be stated formally:

H1: Good financial performance will lead to stronger environmental practices and performance.

H2: Regulatory pressure will lead to stronger environmental practices and performance.

H3: Managerial motivation systems directed towards environmental goals will lead to stronger environmental practices and performance.

H4: Stronger environmental practices will lead to improved environmental performance.

H5a: Stronger environmental performance will lead to improved financial performance.

H5b: Stronger environmental performance will lead to poorer financial performance.

Methodology

The hypotheses were investigated using multiple regression analysis on data drawn from a group of 80 TNCs, all of which had annual revenues of more than $1 billion and headquarters located primarily in Europe, North America and Japan. In the initial sample were the 169 TNCs that responded to the Benchmark Survey on Corporate Environmental Management, conducted by the Transnational Corporations and Management Division of the United Nations Department of Economic and Social Development. Results of this survey, including descriptive statistics, were published in UN-TCMD (1993).

Data sources

The United Nations Benchmark Survey (appendix 1) provided data on environmental procedures and policies as well as on organizational variables such as incentives and performance evaluation. Financial data were collected from the WorldScope and Disclosure data bases, supplemented for some companies by data from annual reports.

In the absence of an adequate measure of corporate environmental performance on a worldwide basis, the study focused on the environmental performance of the United States-based facilities of the TNCs identified in the UN-TCMD (1993) survey. The Toxic Chemical Release Inventory (TRI) data of the Environmental Protection Agency (EPA) serves as a comprehensive and relatively reliable set of data on environmental performance over a number of years. Under Title III of the Superfund Amendments and Reauthorization Act of 1986,[1] most United States-based facilities need to report the quantity of routine and accidental emissions into the air, land or water of more than 300 specified chemicals.[2] Out of the 169 respondents to the United Nations Benchmark Survey, TRI data were available for about 80 TNCs. The EPA was also the source of data on the number of National Priority List (Superfund) sites for which each company was responsible.[3]

Operationalization of the variables

1. *Financial pressure*

Financial pressure on a firm was measured in terms of return on sales (ROS87-9), return on assets (ROA87-9) and the current ratio (LIQ87-9). For each of these measures, an average statistic was computed for the three-year period 1987 to 1989. This period was chosen because financial pressure might be expected to influence *future* environmental practices and performance, due to time lags in organizational responses. ROS87-9 and ROA87-9 were highly correlated and yielded similar results; results are shown for ROA87-9 only.

[1] Section 313 of the Emergency Planning and Community Right-to-Know Act.

[2] A facility needs to report TRI data if it has more than 10 full-time employees, is classified under SIC codes 20 to 39 and uses more than 10,000 pounds of a listed chemical a year. Agricultural, mining and mineral extraction activities are notable exceptions to the reporting requirement.

[3] Superfund sites, more formally known as sites on the EPA's National Priority List, are the most seriously polluted locations in the United States. These sites create the potential for substantial legal liability and will have forced the companies into negotiations with the EPA.

2. *Regulatory pressure and firm bargaining power*

Regulatory and public pressures on a firm were assessed in terms of the number of Superfund sites for which the company was responsible in 1990 (SUPFUND); company size (COSIZE), measured as 1990 consolidated revenues in dollars; the number of potentially hazardous activities in which the firm is engaged (HAZARD); and the degree of transnationality (MULTIRVA); HAZARD was calculated as the number of "yes" responses to question 13 on the Benchmark Survey. The degree of transnationality was calculated as the mean proportion of sales outside the home country for the years 1989 and 1990. This value was then adjusted to reflect the fact that TNCs from smaller countries generally have a higher proportion of foreign sales. The average degree of transnationality for each region was calculated and then expressed as a proportion of the average for United States-based TNCs. For example, the degree of transnationality for Japanese companies was, on average, equal to 1.076 times that of United States-based TNCs; the adjusted statistic for Japanese companies was therefore taken as the unadjusted figure divided by 1.076. The adjustment factor for each of the five regions is as below:

United States	1.000	
Canada and Australia	1.727	
Large European countries	2.179	(i.e., Germany, United Kingdom, France, Italy)
Small European countries	2.353	(i.e., Switzerland, Sweden, Belgium, Netherlands)
Japan	1.076	

It was expected that regulatory pressure would be offset by corporate bargaining power. This was measured in terms of company size and degree of transnationality using the same variables (COSIZE and MULTIRVA).

3. *Organizational variables*

The degree to which incentives exist to motivate facility managers to pursue environmental goals was measured using responses to question 19 of the United Nations Benchmark Survey. The variable INCENTIVE was the number of "yes" responses to this question, with potential scores of 0 to 3, with 3 representing the highest level of organizational incentive. A second variable, FUNCTIONS, was the number of organizational functional areas

that initiate environmental programmes (question 10 in the survey). The existence of a formal allocation of responsibilities between headquarters and foreign affiliates constitutes the third organizational variable, SUBRESP (question 18a).

4. *Environmental policies and procedures*

The nature and extent of environmental policies and procedures was measured by summing each firm's positive responses to a number of questions on the Benchmark Survey.[4] The variable INFORM was the number of "yes" responses to question 4, with potential scores of 0 to 4, with higher values representing more dissemination of environmental information. The variable POLICIES, representing the comprehensiveness of environmental policies, was measured as the total number of "yes" responses to questions 5, 6 and 8, with potential scores of 0 to 45.[5] The comprehensiveness of environmental programmes was captured in the variable PROGRM, which was based on the number of "yes" responses to question 22, with potential scores of 0 to 19. It is worthwhile to note that these three variables capture different aspects of environmental practice: PROGRM represents concrete environmental activities that a company is pursuing; INFORM relates to corporate information and public relations; POLICIES represents specific written policies and procedures.

5. *Environmental performance*

Environmental performance was measured as the change in TRI emissions between the two-year period 1988-1989 and the period 1990-1991. This period was chosen because TRI data prior to 1988 are not considered reliable, and 1991 was the most recent year of data available. A search was performed for all facilities reporting TRI data that were owned and operated by parent companies in the United Nations Benchmark Survey. In order to eliminate the effect of acquisitions, divestitures, and plant openings and closings, a particular set of facilities was tracked over the four-year period for each parent company.[6] This set included only those facilities that reported

[4] When these integer values are used as dependent variables, the appropriate statistical technique is, strictly speaking, the multinomial probit or logit model. However, the majority of social science researchers believe that little harm is done by treating these as interval scales and using ordinary least squares regression (DeVellis, 1991, p. 112).

[5] Questions 5, 6 and 8 are highly correlated with each other.

[6] The EPA assigns each reporting facility in the United States a unique TRI site identifier. Unfortunately, the EPA does not reliably include information about the parent company, so this had to be obtained from various sources.

emissions for the entire four-year period and that remained under the ownership of the same parent company. Another problem with TRI data is that the list of chemicals to be reported changes from year to year. This study used data on nearly 300 chemicals that remained on the list for all four years.

The EPA reports three categories of emissions: direct emissions into the air, land or water; transfers to publicly-owned treatment works (i.e., sewage); and transfers off-site for storage, recycling, or other purposes. This study used the first two categories, as the third does not necessarily result in toxic emissions and is very small compared to the other two. Emissions for each facility were then summed to give total emissions, in pounds, for each parent company for each year. The environmental performance variable, TRICH2, was then calculated as the ratio: (emissions in 1990+1991)/(emissions in 1988+1989). A ratio less than unity, therefore, indicates an improvement in environmental performance.

The variable TRICH2 should reflect a firm's success in reducing pollution over time. The focus on specific facilities and chemicals eliminates other sources of variation, while the use of a ratio enables meaningful comparisons to be made across firms and industries. Nevertheless, in some industries it might be much easier to reduce emissions than in others; moreover, one would expect emissions to vary with the output of each facility. Unfortunately, facility-output data were not available, and efforts to find a proxy proved fruitless.[7]

6. *Financial performance*

To examine the impact of environmental performance on financial performance, financial-performance data were collected for the period 1991-1992. By collecting financial-performance data from this period, the effect of financial pressure as an independent variable (during the years 1987-1989) could be separated from financial performance as a dependent variable. Moreover, these time periods were reasonable given the hypothesized directions of causation and the expected time lags in the model. It should be noted that the financial-performance data illustrate short-term effects only,

[7] Data were collected on several potential control variables, such as change in United States sales and assets, and a proxy for change in worldwide capacity utilization. The problem is that sales and assets can change due to acquisitions, divestitures or greater foreign sourcing, rather than changes in output in existing facilities. The capacity utilization proxy could only be calculated on a worldwide basis because of a lack of regional data. None of the potential control variables were significantly correlated with changes in emissions.

as insufficient time has elapsed to evaluate long-term effects. As the actual levels of profitability in 1991-1992 were strongly correlated with the financial-pressure data from the earlier period, financial performance was measured as the percentage point *change* in profitability, in terms of return on sales and assets, between the earlier period (1987-1989) and the latter period (1991-1992). These variables were labelled ROSCHG and ROACHG, respectively. A final measure of performance was sales growth 1990 to 1992 (GRTH90-2).

7. *Control variables*

Two dummy variables, DJAP and DEUR, were used to capture regional effects for TNCs based in Japan and Europe. In some regressions, variables already described were used as control variables where appropriate.

The variables used in this study are summarized in table 1 below.

Results

Explaining environmental practice

The regression results in table 2 do not support H1, the hypothesis that environmental practice is constrained by financial pressure. The variables representing regulatory and public pressures do have a significant effect in most of the regressions, supporting H2 and H3. The number of hazardous activities is a significant explanatory variable for the degree of corporate information, and approaches significance for environmental programmes. The number of superfund sites had the expected positive effect on environmental programmes, but not on information or policies.

Larger companies tend to disseminate more information and have more extensive environmental policies and programmes. One interpretation is that large companies are more subject to regulatory and public pressures to show good environmental practices; if company size raises bargaining power, the results do not indicate that this leads to lower standards of environmental practice. The degree of transnationality has the opposite effect on environmental information compared with company size; companies that are more transnational in terms of revenues tend to be less forthcoming with corporate information.

Table 1. Summary of variables

1. *Financial pressure*	
ROS87-9	Return on sales, average 1987-1989.
ROA87-9	Return on assets, average 1987-1989.
LIQ87-9	Current ratio, average 1987-1989.
2. *Regulatory pressure and bargaining power*	
COSIZE	1990 Consolidated Revenues, millions of dollars.
SUPFUND	Number of Superfund sites, 1990.
MULTIRVA	Foreign sales as a proportion of total sales for 1989 and 1990, adjusted for country size.
HAZARD	Number of potentially hazardous corporate activities; number of "yes" responses to q. 13.
3. *Organizational variables*	
INCENTIVE	Organizational incentives; Number of "yes" responses to q. 19.
FUNCTION	Organizational functions that initiate environmental programmes; number of "yes" responses to q. 10.
SUBRESP	Formal allocation of responsibilities for environmental management exists between headquarters and affiliates; 1 if "yes" response to q. 18a.
4. *Environmental practices (policies and procedures)*	
INFORM	Extent of environmental information; number of "yes" responses to q. 4.
POLICIES	Extent of environmental policies; number of "yes" responses to qs. 5, 6 and 8.
PROGRM	Extent of environmental programmes; number of "yes" responses to q. 22.
5. *Environmental performance*	
TRICH2	Ratio (TRI emissions in 1990+1991)/(TRI emissions in 1988+1989).
6. *Financial performance*	
ROSCHG	Change in return on sales between 1987-1989 and 1991-1992.
ROACHG	Change in return on assets between 1987-1989 and 1991-1992.
GRTH90-2	Sales growth 1990 to 1992.

Source: Author's estimates.

Table 2. Explaining environmental practices: extent of corporate information, policies and programmes

Independent variable	Dependent variables					
	INFORM	*INFORM*	*POLICIES*	*POLICIES*	*PROGRM*	*PROGRM*
CONSTANT	1.779**	1.343***	8.936	11.245***	3.358	3.614***
	(2.5)	(2.91)	(1.25)	(3.3)	(1.52)	(3.4)
LIQ87-9	-0.4349		-0.059		-0.612	
	(-1.35)		(-0.02)		(-0.61)	
ROA87-9	0.03835		0.0920		0.0711	
	(1.09)		(0.23)		(0.65)	
COSIZE	0.000052***	0.000054***	0.00021	0.00022*	0.00011**	0.00009**
	(3.71)	(3.95)	(1.45)	(1.68)	(2.47)	(2.35)
SUPFUND	-0.00169		-0.0143		0.1224*	0.0728
	(-0.07)		(-0.07)		(1.68)	(1.05)
MULTIRVA	-0.018664*	-0.016081*	0.0692		-0.0066	
	(-1.9)	(-1.68)	(0.68)		(-0.21)	
INCENTIVE	0.2986*	0.3064**	3.065*	3.521*	1.3347***	1.1182**
	(1.94)	(2.08)	(1.90)	(2.6)	(2.78)	(2.59)
FUNCTIONS	0.06963		1.0165	0.8869	-0.1386	
	(0.99)		(1.4)	(1.47)	(-0.63)	
SUBRESP	0.8158***	0.7177**	6.341**	6.266**	1.6357*	1.7267**
	(2.72)	(2.5)	(2.07)	(2.34)	(1.75)	(1.99)
HAZARD	0.03844	0.05570*	-0.1305	-0.2184	0.1277	0.1256
	(1.2)	(1.89)	(-0.4)	(-0.8)	(1.28)	(1.41)
DJAP	-1.3235***	-1.2489***	-3.868	-3.022	0.632	
	(-2.8)	(-3.39)	(-0.81)	(-0.83)	(0.43)	
DEUR	-0.6702*	-0.7775**	-8.107*	-7.143**	-1.233	-2.066**
	(-1.89)	(-2.37)	(-2.25)	(-2.34)	(-1.12)	(-2.1)
N	74	76	75	84	74	84
F-Stat.	5.46***	8.6***	2.27**	4.19***	4.52***	6.85***
R^2	49.2	47.0	28.3	27.8	44.5	34.8
Adj. R^2	40.2	41.5	15.8	21.2	34.6	29.7

Source: Author's estimates based on UN-TCMD (1993).
Note: Figures in parentheses are t-statistics. * p<0.1. ** p<0.05. *** p<0.01.

Two organizational variables, personal incentives and a formal allocation of environmental responsibilities to affiliates, had the anticipated positive impact on all three aspects of environmental practice. The number of organizational functions that initiate environmental programmes approached significance as a determinant of environmental policies, but not for information or programmes.[8]

The dummy variables for Japan and Europe were generally negative and significant, suggesting that North American companies tend to have better environmental practices, after taking other factors into account. Nevertheless, the difference is greatest in the "words" rather than the "deeds" aspects of practice: concerning programmes, there is very little difference.

Explaining environmental performance

There was a surprisingly weak relationship between environmental practices and environmental performance; H4 is not supported. Table 3 shows that, when data from all three regions are examined together, the only significant variable was DJAP, the dummy variable for Japan.[9] This suggests that Japanese-owned plants in the United States had consistently worse environmental performances than plants with ownership from other regions, perhaps because Japanese TNCs were rapidly building up their United States operations during that period. Data from European-owned facilities tell a more interesting story. The second column of the regression results indicates that, as expected, companies with stronger environmental policies had better environmental performances. However, greater dissemination of environmental information was associated with *poorer* environmental performance.

It should be noted that data on environmental practices and performances pertain to similar time periods, and that causation might run in both directions: not only are companies with stronger environmental practices expected to show better environmental performances, but companies with poor performances might be expected to react by strengthening their practices.

[8] In the sub-sample of United States TNCs, FUNCTIONS was a significant determinant of both POLICIES and PROGRM.

[9] An examination of the residuals, separated by region, revealed evidence of heteroscedasticity in this regression model, which would bias the estimates of standard errors of parameters (though not the estimates of the coefficients). Regression equations were therefore estimated for each region separately. Only Europe showed a different pattern. I thank Professor Janet Wagner for her assistance on this point.

Table 3. Environmental practices and environmental performances

Independent variable	Dependent variable: change in TRI emissions between 1988-1989 and 1990-1991 (TRICH2)	
	All regions	Europe
CONSTANT	0.7876***	0.968***
	(5.35)	(6.65)
INFORM	0.0375	0.105*
	(0.89)	(1.82)
POLICIES	-0.0032	-0.0283***
	(-0.71)	(-3.13)
PROGRM	0.0094	
	(0.68)	
HAZARD	-0.0032	0.02088
	(-0.30)	(1.28)
DJAP	0.4223***	
	(3.34)	
DEUR	0.0823	
	(0.66)	
N	82	19
F-Stat.	2.27**	3.33**
R^2	15.3	40.0
Adj. R^2	8.6	28.0

Source: Author's estimates based on UN-TCMD (1993).

Note: Figures in parentheses are t-statistics.

* p<0.1.

** p<0.05.

*** p<0.01.

This could account for the lack of a significant correlation in the overall data. Unfortunately, the methodology employed here does not allow the two effects to be separated.

The conceptual model (figure 1) suggests that environmental performance might be directly affected by financial, regulatory and organizational variables. Table 4 shows that, while financial factors were not statistically significant, the organizational variables did indeed have a significant relationship with environmental performance. Although larger companies were earlier found to have stronger environmental practices, the results show that larger companies were strongly associated with *poorer* environmental performances.

Table 4. Financial, regulatory and organizational factors, and environmental performances

Independent variable	Dependent variable: change in TRI emissions between 1988-1989 and 1990-1991 (TRICH2)	
CONSTANT	0.5988**	0.62***
	(2.45)	(2.69)
LIQ87-9	0.1489	0.143
	(1.3)	(1.28)
ROA87-9	0.00603	0.00552
	(0.49)	(0.47)
COSIZE	0.000016***	0.0000165***
	(3.32)	3.68
SUPFUND	-0.010932	-0.0119 (p=0.114)
	(-1.37)	(-1.6)
MULTIRVA	-0.00544	-0.00568*
	(-1.62)	(-1.77)
INCENTIVE	0.10945**	0.1104**
	(2.07)	(2.13)
FUNCTIONS	0.03171	0.03515 (p=0.105)
	(1.31)	(1.65)
SUBRESP	-0.0145	
	(-0.14)	
HAZARD	-0.0166	-0.0174 (p=0.103)
	(-1.52)	(-1.65)
DJAP	0.0517	
	(0.32)	
DEUR	-0.0595	-0.0725
	-0.48	(-0.62)
N	72	72
F-Stat.	3.05***	3.83***
R^2	35.9	35.7
Adj. R^2	24.1	26.4

Source: Author's estimates based on UN-TCMD (1993).

Note: Figures in parentheses are t-statistics.

* p<0.1.

** p<0.05.

*** p<0.01.

One interpretation is that larger firms have more power to resist expensive environmental investments, but are willing to strengthen their practices and procedures, which are relatively cheap by comparison. An alternative explanation is that larger firms have a greater degree of complexity and bureaucratic inertia that impedes improvements in environmental performance.

Although companies with a higher degree of transnationality were earlier found to be less forthcoming with environmental information, table 4 suggests that companies with a higher degree of transnationality are weakly associated with superior environmental performance. One explanation is that transnationality raises the pressure on a company more than it increases its bargaining power. A second possibility is that TNCs take the costs of pollution into account when making facility location decisions; if the United States is a high cost location for pollution-intensive operations, companies that are more transnational would have a greater tendency to move pollution-intensive activities to other countries.

The variables SUPFUND and HAZARD both approach significance at the 10 per cent level, suggesting (rather weakly) that companies with more regulatory exposure from Superfund sites and from the diversity of their hazardous activities tend to have better environmental performance.

Table 4 also reveals that the two organizational variables, INCENTIVE and FUNCTIONS, are related to environmental performance, the former at the 5 per cent significance level and the latter approaching the 10 per cent level; the direction of correlation, however, is opposite to that expected. Again, it is possible that reverse causation is at work: companies with poorer environmental performances could respond by instituting organizational measures expected to improve performances in the future.

Environmental performance and subsequent financial performance

The extent to which environmental performance influenced subsequent financial performances was examined by regressing three different measures of financial and market performances on TRICH2, representing the change in TRI emissions, and on other variables. The results are shown in table 5.[10]

[10] The regressions in this table also revealed evidence of heteroscedasticity with respect to regions. Regression equations for each region did not show markedly different results, except that HAZARD was not significantly associated with ROSCHG outside of North America.

The coefficient on TRICH2, though not statistically significant, was consistently positive, suggesting that firms with larger reductions in toxic emissions were, if anything, associated with poorer financial performance. The evidence clearly does not support H5a, and gives very weak support to H5b. The number of environmentally hazardous activities was associated with poorer financial performance on all three measures, significantly so in the case of return on sales.

Table 5. The relationship between environmental and financial performances

Independent variable	Dependent variables		
	ROACHG	*ROSCHG*	*GRTH90-2*
CONSTANT	-7.3***	-5.313**	-5.966
	(-2.87)	(-2.34)	(-0.65)
TRICH2	0.664	1.046	6.373
	(0.43)	(0.76)	(1.16)
SUPERFUND	0.0546	0.04376	-0.1760
	(0.54)	(0.49)	(-0.5)
HAZARD	-0.194	-0.2481**	-0.0866
	(-1.54)	(-2.21)	(-0.19)
COSIZE	0.000033	0.000022	-0.000442**
	(0.51)	(0.38)	(-1.9)
MULTIRVA	0.077*	0.0659*	0.1806
	(1.77)	(1.69)	(1.16)
DJAP	5.349***	3.881**	34.79***
	(3.25)	(2.62)	(5.86)
DEUR	1.722	1.224	-6.439
	(1.14)	(0.90)	(-1.18)
N	69	70	69
F-Stat.	3.01***	2.79**	8.07***
R^2	25.7	24.0	48.1
Adj. R^2	17.2	15.4	42.1

Source: Author's estimates based on UN-TCMD (1993).

Note: Figures in parentheses are t-statistics.

* $p<0.1$.

** $p<0.05$.

*** $p<0.01$.

Conclusions and policy implications

The results support the argument that regulatory pressure and organizational incentives have a strong influence on environmental policies and procedures. In particular, large TNCs that integrated environmental performances into personnel practices and formally allocated environmental responsibilities to affiliates tended to have the most comprehensive practices in terms of information dissemination, policies and programmes. These environmental practices did not, however, have a significant relationship with environmental performances. This surprising finding indicates that an emphasis on written policies and procedures is not necessarily the most effective way to improve environmental performances. The finding that larger companies were strongly associated with better practices but poorer performance underlines the importance of this distinction. It leaves larger companies open to the charge that they are avoiding costly environmental investments and perhaps engaging in window-dressing. Also troubling is the finding that improving environmental performance is not associated with better financial performance in subsequent years; if anything, the reverse is more likely to be the case. The optimistic talk about "win-win" solutions will have to be reconsidered.

The results hold a number of public policy implications. If reducing emissions does not yield significant financial benefits, private firms cannot be expected to make the necessary investments of their own volition. This points to a role for Governments to intervene to spur corporate efforts in the desired direction. The findings suggest that such intervention would be most effective if it directly targets emissions rather than corporate practices. This approach is also attractive because it is likely to be simpler and less costly to monitor and enforce than detailed control over practices. Moreover, it gives companies the flexibility to pursue emissions reductions in innovative and cost-effective ways.

Intervention does not necessarily have to take the form of regulatory mandates. In the United States, the EPA has established a voluntary programme under which companies are asked to commit to reduce their emissions of 17 chemicals by 33 per cent by 1992 and by 50 per cent by 1995.[11] The success of such programmes rests on a credible threat of regulation if companies fail to cooperate and on an effective system for reporting emissions. Currently, most countries do not collect data as detailed or as comprehensive as the TRI system provided in the United States.

[11] The base year for measuring the reduction is 1988. Results of the programme have not yet been published.

The finding that larger companies have poorer environmental performances is especially worrying given that, in many industries, a few large companies account for a high proportion of emissions. If the relatively poor performances of larger firms is due to organizational reasons, such as complexity and bureaucratic inertia, these firms could be encouraged to give greater visibility and priority to environmental efforts, for example, by appointing senior-level officers with responsibility for environmental affairs. If the inferior environmental performances of larger firms is due to their power, there is a need for a stronger regulatory stance, possibly extending to anti-trust policy.

The superior environmental performances of companies that are more transnational in scope could be due to the greater opportunities for intra-firm learning and technology transfer. However, there would be serious public-policy implications if it were caused by the movement of pollution-intensive stages of the value chain to less regulated locations outside the United States. An appropriate response might be a move towards the harmonization of international regulations in a manner similar to that already being undertaken by the European Union.

Overall, the study points to a large variation across companies in both practices and performances. Where there is evidence that one group of companies significantly lags in environmental practices and performance, regulatory authorities need to pay particular attention to this group. The study suggests that this may be case for TNC affiliates whose home countries have less stringent regulations. It should be recognized, however, that only a part of the variation among companies can be explained by the variables used here. There is a need therefore to study companies with the best records and encourage the diffusion of the "best practices"; the networks of communication that already exist among TNC affiliates could facilitate this process at the international level.

The United Nations has played a leading role in conducting research, raising awareness and promoting international agreements about environmental problems. In particular, the United Nations Environmental Programme (UNEP) has, despite a lack of resources, been adept at promoting agreements on ozone protection and the transboundary movement of hazardous waste. The success of UNEP has been attributed to its technical competence, effective leadership and apolitical approach (Young, 1993). Foreign direct investments (FDI) that generate significant hazardous emissions are conceptually related to transboundary movements of waste, just as trade and FDI are closely linked. UNEP could, therefore, be well placed to play a useful role in policy development concerning hazardous emissions by TNCs.

Future research would need to address some of the limitations of this study. This study focused on hazardous emissions; a more comprehensive indicator of environmental performance would include other dimensions such as energy, use and recyclability of a product and its packaging. This study did not control for reverse causation for organizational and regulatory variables, for differences among industries or for changes in plant output. A more sophisticated methodology might address these shortcomings. Future research needs to examine more closely the *reasons* why certain groups of companies have better environmental performances, in order to guide policy making. Finally, there is a need to study those companies with the best practices and performances more closely so that the appropriate techniques can be understood and disseminated. ■

Appendix 1. United Nations Benchmark Survey Questionnaire (*abbreviated*)

[. . .]

Q. 4: Does the corporation have: (*a*) a formal published international environmental policy or programme?; (*b*) a separate environmental report, or a section in the annual report on the environment?; (*c*) a separately identified annual statement on environmental affairs for the corporate board?; (*d*) an environmental bulletin or newsletter for managers throughout the company?

Q. 5: Do you have specific company-wide environmental policies and standards, beyond those required by national law or regulations, in the following areas: (22 items, including air and water quality, waste disposal and accident prevention).

Q. 6: Has the company prepared its own standardized version of the following procedures and programmes for use throughout the firm? (12 items, including pollution monitoring, environmental audits and hazard assessment procedures.)

[. . .]

Q. 8: What other measures are important components of the company's international environmental programme? (11 items, including safety and environmental audits, environmental accounting and annual meetings with local environmental officials.)

[. . .]

Q. 10: Please indicate the extent to which the different divisions/functions of your corporation initiate environmental programmes: (9 functions, including top management, accounting and marketing).

[. . .]

Q. 13: Information regarding those corporate activities that have the potential for serious detrimental effects on the environment. Please indicate whether any of the company's operations presently involve any of the following products, processes or activities (34 items).

[. . .]

Q. 18a: Does your company have formal arrangements for allocation of responsibilities on environmental management between corporate headquarters and controlled affiliates?

Q. 19: Personnel practices for plant management and supervisors: are environmental objectives, responsibilities, and performance included in (*a*) incentive schemes; (*b*) an employee's job description; (*c*) performance evaluations.

[. . .]

Q. 22: Please indicate whether any of the following activities describe present corporate programmes or practices: (19 items, ranging from R&D in pollution control to water conservation).

Source: UN-TCMD (1993).

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