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Regulatory Pressure and Environmental Management Infrastructure and Practices

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In this article, we hypothesize that the level of environmentally oriented noncompliance regulatory fines and penalties levied on companies and on their industry counterparts will be associated with the development of an environmental infrastructure and practices within these companies. We find that the presence of these regulatory actions is associated with the likelihood of companies reporting environmental policies and activities and with the presence of a separate board of directors' committee that monitors company environmental concerns. Our findings suggest that environmental regulatory pressure may serve as a driver of environmental action but is not its only determinant.

The development and implementation of corporate environmental strategies has received increased attention in both the practitioner and academic literature in recent years. More than 97% of companies responding to a recent survey indicated that they have environmental strategies in place (Stead & Stead, 1995). This shift to more ecocentric (Shrivastava, 1995a) or proactive environmental management has been driven by pressures from a wide array of stakeholders, including competitors, customers, employees, and governments (Berry & Rondinelli, 1998).

Among these forces, government environmental regulatory pressures may well serve as the key determinant of managerial actions to address environmental demands (Rugman & Verbeke, 1998). Henriques and Sadorsky (1996) found government regulation to be the single most important source of pressure on firms in the development of environmental plans.

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In response to the proliferation of environmental laws that affect the cost of doing business (Throop, Starik, & Rands, 1993), firms need to develop innovative responses to strategically compete in environmentally regulated markets (Sanchez, 1997). Shrivastava and Hart (1994) noted that "the number of new environmental, safety, and health regulations and standards being imposed on organizations each year is staggering" and that "managers must find ways of systematizing the myriad of ad hoc responses their organizations are forced to make to fragmented regulations, and public pressures" (p. 628).

There are conflicting opinions about and a wide range of lenses through which to view the competitive impacts of environmental regulations on firm strategies and performance. On one hand, taking a deterministic view of regulation consistent with the economic literature (Stigler, 1971), managers have often adopted an antagonistic posture toward environmentally responsible behavior. Furthermore, the costs of reducing environmental impact may overshadow the resulting benefits, and organizational performance may actually decline (Hart & Ahuja, 1996; Walley & Whitehead, 1994). By making investment in new facilities more costly and by limiting land use, environmental protection may even slow down economic growth and hurt the world economy (Osterfeld, 1992).

On the other hand, environmental regulations may enhance competitiveness by encouraging efficiency and innovation (Jaffe, Peterson, Portney, & Stavins, 1995; Porter, 1991). Flexibility in environmental regulations may provide firms opportunities to gain competitive advantage (Westley & Vredenburg, 1991). Strong environmental management can also improve financial performance as measured by stock market returns (Klassen & McLaughlin, 1996). In addition, a growing stream of "green management" literature focusing on sustainable development (Gladwin, Kennelly, & Krause, 1995; Shrivastava, 1995c) supports the long-term positive benefits of proactive environmental management.

Regardless, however, of whether environmental regulations benefit the firm, they do significantly influence competitive behavior by generating new costs and by providing new opportunities to address them (Shrivastava, 1995b). We consider this relationship by examining the association between the firm's environmental noncompliance costs in terms of fines and penalties and its corresponding environmental management infrastructure.

When a company receives a fine for an environmental violation, there is a range of possible outcomes. At one extreme, a company might make the minimum changes necessary to avoid further penalties and fines, which could include attempts to cover up or hide the offending behavior. At the other extreme, the fines and penalties could serve as a wake-up call.

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Here, the firm's managers not only correct the specific problem that elicited the fine but also develop an infrastructure that would lessen the company's negative environmental impact and thus its exposure to subsequent fines.

Our purpose in this article is to examine whether fines and penalties are associated with subsequent corporate environmentally friendly infrastructure developments. In other words, we address the question of whether fines and penalties not only punish corporations but also rehabilitate poor environmental performance. The study is important because it should shed light on the depth of the impact of environmental regulation and the relative size of fines on corporate behavior.

LINKAGE OF FINES AND PENALTIES AND ENVIRONMENTAL MANAGEMENT INFRASTRUCTURE

Fines and penalties resulting from noncompliance with environmental regulations impose additional costs on the firm and help shape strategic responses to them. Under the theory of rational choice, often called the institutional theory of action (March & Olsen, 1989), decisions are based on the costs and benefits of various alternatives. According to this rule-based theory of decision making, managers implement decisions by applying corporate rules that are both formal and informal. Our premise is that for environmental regulation to be effective, it must change these corporate rules and thereby change the way decisions are made. Otherwise, the preexisting rules will dominate, and these are the rules that led to the assessment of environmental noncompliance fines and penalties. When a firm has been fined for environmental noncompliance, assuming that the fines are material, a rational outcome would be for the firm to avoid future fines. Again, assuming the fines are material, and making the additional assumption that the regulatory agencies are good at detecting environmental violations, the rational firm would change its behavior. Fully changing firm behavior would involve creating an infrastructure that lessens the likelihood of receiving additional environmental penalties. By changing the infrastructure, the corporation sets new rules and puts rule-making machinery into place that is designed to lessen the likelihood of future environmental fines and penalties.

This rational outcome does assume that fines are material and detection of future environmental problems is likely. Should either assumption be violated, the rational company might elect to "fix" only the specific violation but would be less likely to develop a broader corporate environmentally friendly infrastructure and to change its decision-making rules.

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One key strategic variable in dealing with such regulatory pressures is the nature of the firm's environmental management infrastructure. Developing an environmental strategy alone is not enough. Consistent with the configurational theories' notion of fit among strategic and structural factors (Doty, Glick, & Huber, 1993), the firm's structure must also be effectively organized to implement the strategy (Epstein, 1996).

Stead, McKinney, and Stead (1998) argued that "institutionalization is a pivotal organizational process which determines whether a firm's environmental performance results in improved operating efficiency and market opportunities or in increased legal and regulatory hassles" (p. 261). While the authors find that U.S. firms have improved institutionalization of environmental matters, they also show that firms that fail in this area may suffer "dire consequences, such as jail terms for strategic managers" (p. 261). This evidence is consistent with our proposed thesis that after fines and penalties, a rational firm may adapt its environmental infrastructure and thereby institutionalize the process to avoid subsequent fines and penalties.

Stead and colleagues (1998) also argued that managing environmental performance is difficult. Firms must create the infrastructure and environmental policies and attitudes that permit environmentally friendly activities to occur. Research in this area shows that these fundamental changes are difficult to establish and maintain (Hart, 1995; Post & Altman, 1992, 1994; Ruckelhaus, 1991; Starik & Rand, 1995; Stead & Stead, 1994, 1995, 1996).

Government regulation affects strategic choice (Cook, Shortell, Conrad, & Morrisey, 1983) and may lead to a misalignment of an organization with its context. However, consistent with the resource-based view of the firm (Barney, 1991; Conner, 1991; Grant, 1991) and with the environmentally enhanced, natural resource-based view of the firm (Hart, 1995), an organization's internal capabilities can be marshaled to neutralize external threats and to realign the firm with its context. We argue that regulation, if successful, will encourage corporations to institutionalize environmental policies by creating an environmentally sensitive infrastructure.

The structuring of environmental management has been evolutionary and involves both internal and external activities (Baron, 1996). Externally, firms address the management of environmental issues through direct interactions with stakeholders, such as consumers, insurance companies, investors, and environmentalists, and in institutional arenas, such as courts, state legislatures, Congress, and regulatory agencies. Internally, environmental demands are met through technology enhancements, development of environmental strategies, and organization of staff for environmental compliance. The structural history of corporate environ-

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mentalism has also evolved from an ancillary posture in the 1960s to an integrated one in the 1990s (Hoffman, 1997).

Environmental Infrastructure and Specific Hypotheses

Organizational structure serves as an essential building block of environmental commitment, and firms have increasingly made the transition to a more comprehensive structural response mode. Environmentalism has necessitated an evolutionary reassignment of duties and responsibilities. Old structural relationships have been altered to respond to new environmental demands. We investigate environmental management by examining five characteristics representative of a proactive environmental management infrastructure: (a) few reporting levels between the senior environmental officer and the chief executive officer (CEO), (b) a greater likelihood of reporting environmental policies, (c) a separate board of directors' committee that monitors company environmental policies, (d) high environmental staffing levels, and (e) a greater proportion of company facilities that are environmentally audited. These infrastructure changes have not been investigated in past literature but are items reported by the Investor Responsibility Research Center (IRRC, 1997). Together, these five infrastructure attributes give a good reading of readiness to respond to environmental demands.

Our general premise is that fines and penalties associated with noncompliance to environmental regulations serve as a major driver of corporate environmental action by helping to shape structural responses to them. We suggest that a company may be more likely to have a comprehensive environmental management system in place if it has experienced high levels of environmental fines and penalties.

One could argue just the opposite, that firms with a large number of fines and penalties would have a less well-defined infrastructure. This lack of infrastructure would explain the penalties and fines. However, if we follow the logic of the rational decision-making firm, and if we assume material-size fines and effective regulators, we argue that regulation instituted and made effective by fines and penalties will cause a shift in corporate behavior and the creation of an environmentally sensitive infrastructure.

Failure to create this infrastructure following fines and penalties would lead us to conclude either that regulation is ineffective (e.g., the fines are immaterial or the chances of getting caught are low) or that corporate decisions are filtered by a non-environmentally friendly corporate history and culture (Rehbein & Schuler, 1999). Thus, whether heavily fined firms create an environmentally sensitive infrastructure is an important empirical

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issue that addresses the more fundamental question of whether or not environmental regulation is effective.

Prior research has shown that firms fined for environmental violations suffer significant losses in market value (Karpoff, Lott, & Rankine, 1998). Using the five environmental infrastructure components identified above with the extent of the noncompliance environmental fines and penalties, we formulate five hypotheses.

The first hypothesis relates to how close in the scalar chain the head environmental officer is to the CEO. In the early 1990s, more firms began to make executive-level environmental appointments. De Boerr (1992) reported that in 1991, 31 of the *Fortune* 50 had environmental vice presidents, as did 49 of the *Fortune* 100, which is an increase over earlier years. The higher up in the hierarchy the leading environmental officer is, the more power he or she may have to influence corporate behavior. Furthermore, environmental appointments near the top are likely to signal others throughout the organization that top management is committed to the successful management of environmental matters.

At the time that a company is initially fined or investigated for poor environmental performance, it is likely that there may be no formal environmental officer. After the fines have been levied, one outcome may be for the corporation to begin taking environmental issues more seriously. Thus, we expect that firms faced with large fines and a large number of penalties will, after a time lag, have environmental officers in positions of importance in the corporate hierarchy. If this is not true, then the fines may change only a specific environmental problem as opposed to changing the corporation's environmental culture.

Hypothesis 1: Firms with a greater magnitude of environmental noncompliance fines and penalties levied against them will be more likely to have fewer intervening reporting levels between the senior environmental officer and the CEO.

The second hypothesis deals with the likelihood of the firm reporting its environmental practices. Firms report environmental activities in a wide range of sources including government documents, financial statements, annual reports, press releases, and standardized environmental reports such as those created by the IRRC. Today, businesses are increasingly disclosing environmental issues. Few firms, for example, produced environmental reports as recently as 1990, but, by 1997, 43% of U.S. companies did so ("Environmental Annual Reports," 1998). Corporations have increased their level of environmental data benchmarking as the importance of environmental performance continues to expand (Naimon,

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1994). Reasons why firms are coming forward include a desire to project an image of environmental responsibility, an attempt to signal overall quality of management by demonstrating an ability to avoid environmental problems, and the need to report costs and liabilities that are associated with the noncompliance with environmental laws (Stanwick & Hillison, 1992/1993). Shareholder activism may have also influenced environmental reporting. Shareholder activism is becoming an increasingly important area of concern for both managers and researchers (Admati, Pfleiderer, & Zechner, 1994; Smith, 1996), and it has been shown to have made small changes on firms' governance structures (Karpoff, 1998). It is important for managers to determine what information investors and other stakeholders need, particularly concerning the company's environmental policy (Mastrandonas & Strife, 1992). Environmental issues have been identified as the third most active shareholder concern (Donnelly, 1995). Sanctions invoked for socially undesirable corporate activities may be sufficient to affect the value of the firm (Spicer, 1978). What companies are reporting is important because both knowledgeable and socially conscious investors are seeking this information (Kreuze, Newell, & Newell, 1996). A company that has had previous environmental problems may feel extra pressure from stakeholders to show that it is trying to improve, so although firms may not report environmentally friendly activity prior to being fined, one outcome of the fines may be to promote environmental reporting.

Hypothesis 2: Firms with a greater magnitude of environmental noncompliance fines and penalties levied against them will be more likely to report their environmental policies.

Hypothesis 3 considers the existence of a separate board of directors' committee that monitors company environmental policies. By 1992, more than a third of *Fortune* 100 companies' boards of directors had environmental committees (Cahill & Engelman, 1993). The logic for these is similar to that presented in the discussion regarding Hypothesis 1: Having environmental committees demonstrates top management commitment. Costs for environmental noncompliance can be extensive, and such committees ensure that environmental concerns will be in permanent contact with board-level decision making.

We again expect that one outcome of fines and penalties for environmental noncompliance would be for companies to install an environmentally friendly infrastructure. If the board of directors establishes a committee to oversee environmental matters, there would appear to be top-level commitment. Although these board committees may not exist at the time

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the fines are levied, companies may initiate environmentally friendly activity, such as the creation of the board committees, after fines and penalties are levied.

> *Hypothesis 3*: Firms with a greater magnitude of environmental noncompliance fines and penalties levied against them will be more likely to have a separate board of directors' committee that monitors company environmental policies.

Hypothesis 4 deals with broader environmental staffing levels within the firm. As firms progress to more proactive environmental postures over time, not only do environmental concerns move up to top levels within the firm, but environmental responsibilities also diffuse throughout much of the organization and spread across functional boundaries. Hoffman (1997) noted,

> While some sort of a dedicated environmental affairs department will always be necessary as long as regulations continue to be written, more of the responsibility for carrying out corporate environmental activities will fall to the core functions of the firm, which are better equipped to handle these issues. (p. 15)

The need to have additional staff involved in environmental management may be particularly strong for those firms that have experienced significant costs in the past for failures to comply with environmental regulations. We expect that one outcome of the fines and penalties would be for companies to create higher staffing levels devoted to environmental activities.

> *Hypothesis 4*: Firms with a greater magnitude of environmental noncompliance fines and penalties levied against them will be more likely to have high environmental staffing levels.

The final hypothesis, Hypothesis 5, deals with the extent to which firms conduct environmental audits of their facilities. Environmental control programs require ongoing technological and scientific data to ensure that programs are consistent with policies and regulatory demands (Hamilton, 1995). In assessing a firm's exposure to environmental contingencies, an auditor's knowledge of the company's business is fundamental, and procedures that auditors perform might bring possible noncompliance to their attention (Kolins & Jones, 1994). One outcome of the fines and penalties would be for companies to begin larger scale environmental audits.

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Hypothesis 5: Firms with a greater magnitude of environmental noncompliance fines and penalties levied against them will be more likely to audit a greater proportion of their facilities.

METHOD

Sample and Data

We obtained data for our study from the *Corporate Environmental Performance Analysis and Summary*, published in 1997 by the IRRC, which "compiles and analyzes information on the activities of corporations and institutional investors" (IRRC, 1997, preface). The *Corporate Environmental Performance Analysis* is compiled by the IRRC's environmental information service staff. The IRRC obtains environmental penalty and fine data on *Fortune* 500 companies from public records. This information is available to us for all of our sample firms. Data about corporate environmental policies come directly from the companies to the IRRC. Because companies can choose to report their environmental policies to the IRRC, we have information about environmental policies only when a company supplies this information to the IRRC.

It is important to note that because we rely on the IRRC data, our data could suffer from a respondent bias. If companies that do not report to the IRRC are different than our sample firms, our results could be biased.

The IRRC provides data by industry for these companies and has divided the *Fortune* 500 into 103 industries. We first selected the industries to examine. We eliminated industries that had only one company in the *Fortune* 500. We eliminated all retail industries and service industries because very few of these companies had environmental fines. This left 36 industries with 224 companies. From the 224 companies, 137 companies reported their environmental policies to the IRRC. Therefore, we have information that the IRRC obtained from public records for all 224 companies and complete data on 137. Table 1 contains a description of the data that we obtained from the IRRC. As shown in Table 1, these are the independent variables included for the tests.

Percentage of facilities audited. The IRRC shows what percentage of a company's domestic facilities have undergone an environmental audit in the previous 2 years. Data are available only for companies that report their environmental policies to the IRRC.

Average number of penalties. The IRRC reports for 1993 to 1995 the number of criminal and civil/administrative penalties assessed against

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Table 1
Environmental Data Across 224 Companies in 36 Industries

	Mean	*Range*	*Median*	*Standard Deviation*	*Number Reporting*
Environmental officer distance from CEO[a]	0.936	0-6	1.000	0.932	137
Facilities audited (%)[b]	65.701	0-100	72.000	33.997	137
Average number of penalties[c]	9.987	0-138	4.000	17.934	224
Fines (% of revenues)[d]	46.810	0-2,265.4	5.910	187.295	224
Company fines (% of industry average)[e]	1.000	0-8.953	0.262	1.639	224
Environmental board committee[f]	0.569	0-1	1.000	0.497	137
Corporate environmental staff[g]	49.307	0-2,000	12.000	178.160	137

Note: CEO = chief executive officer.
a. The Investor Responsibility Research Center (IRRC) reports (for companies that respond to their environmental questionnaire) the number of levels that the senior environmental officer is away from the CEO. A score of 0 implies that the officer reports directly to the CEO. A score of 1 implies that the senior environmental officer reports to someone who reports to the CEO, and so on. These data appeared in the 1997 IRRC report and cover the year 1995.
b. The 1997 IRRC database reports the proportion of facilities of the company audited in the previous 2 years.
c. The 1997 IRRC reports the number of criminal or civil/administrative penalties that the company was assessed between 1993 and 1995.
d. The IRRC computes for each company the sum of the dollar amount of environmental fines for 1993 to 1995 as a percentage of company revenues for the same time period. For the computation, the fines are in dollars, but revenues are measured in millions, as reported by the IRRC.
e. For each company, the IRRC presents the industry average of fines divided by revenues for 1993 to 1995. Our variable is the company's fines as a percentage of revenue divided by industry average.
f. For companies that respond to the IRRC questionnaire, we are able to determine if a company's 1995 board of directors has a committee devoted to environmental concerns. When there is a committee, we score this variable as 1, and we score it 0 otherwise.
g. For companies that respond to the IRRC environmental questionnaire, we can determine the number of employees in 1995 at the corporate level assigned to environmental tasks. As you can see from the table, this distribution is highly skewed. It may be that companies view the words *environmental tasks* differently. This variable may suffer from this lack of specificity, so one must be careful in drawing conclusions about it.

each company under the Resource Conservation Recovery Act; Clean Air Act; Clean Water Act; Safe Drinking Water Act; Toxic Substances Control Act; Federal Insecticide, Fungicide, and Rodenticide Act; Occupational Safety and Health Act; Mining Safety and Health Act; Atomic Energy Act; and Endangered Species Act.

Fines as percentage of revenue. The IRRC computes for each company the sum of the dollar amount of each fine paid under the above-named

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statutes for 1993 to 1995 and divides it by revenues in millions of dollars. The resulting percentages are, therefore, percentages of millions of dollars, not dollars.

Company fines as percentage of industry average. We take the fines as a percentage of revenue for each company and divide by the total fines in the industry. This variable shows if a company's fines are relatively greater or less than average for the industry.

Environmental board committee. The IRRC reports whether, in 1995, the company had a board of directors committee devoted to environmental concerns.

Corporate environmental staff. For companies that report their policies to the IRRC, the IRRC data show the number of employees engaged in environmental efforts at the corporate level.

The IRRC keeps track of and reports penalties, fines, and industry fines for all of the firms in our sample. We also obtained the industry average of fines as a percentage of revenues. However, data on environmental officers, percentage of facilities audited, environmental board committees, and environmental staff are available for only the 137 reporting companies.

For each of the variables, we report the mean, range, median, and standard deviation. For the environmental officer, a score of 0 implies that the officer reports directly to the CEO, whereas a score of 1 implies that there is one level between the environmental officer and the CEO (the officer reports to someone that reports to the CEO). The mean is 0.936. This implies that on average, there is less than one complete level between the environmental officer and the CEO.

The IRRC questions each company about the proportion of domestic assets that received an environmental audit within the prior 2 years. The mean is 65.701%. Thus, on average, environmental audits of more than half of a company's assets occur every 2 years.

We have defined a penalty as the receipt of a criminal or civil/administrative action assessed in the 1993 to 1995 time period. The range for number of penalties is 0 to 138, but the mean is 9.987 penalties per company. Over this time period, the average company received nearly 10 penalties, but one company had 138 penalties.

The IRRC also records the size of environmental fines (in dollars) as a percentage of revenues (in millions of dollars). The mean is 46.810%. Because the IRRC computes the data with fines in dollars and revenues in millions of dollars, this number is 0.0004681% of revenue dollars. This

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same fine statistic is then divided by the industry average. This industry adjusted statistic measures how large fines are relative to what is normal in the industry. This variable averages 1.0. For the two remaining variables, more than half of the firms (56.9%) have environmentally oriented board committees, and they have on average an environmental staff of 49.307 employees.

Data Analysis

For our tests, we used ordinary least squares regression when the dependent variable is either a continuous variable or a group with more than two outcomes. We used logit regression when the dependent variable is a grouping with two outcomes. The dependent variables for these logit regressions are the number of intervening reporting levels between the senior environmental officer and the CEO, a binary variable with the value 1 if the company reports to the IRRC, a binary variable with the value 1 when the company has an environmental board committee, the size of the environmental staff, and the percentage of facilities audited. These variables correspond to the five hypotheses.

The independent variables include the number of penalties, the company fines (in dollars) as a percentage of industry fines (in millions of dollars), the industry average for fines (in dollars) as a percentage of revenues (in millions of dollars), and the company fines (as a percentage of revenue) as a percentage of industry fines (as a percentage of revenues). We include the presence of an environmental board as an independent variable in some regressions because although the board may be part of the infrastructure, it would also influence the rest of the infrastructure. We do not include it as an independent variable when we examine the determinants of this committee nor when we examine the determinants of which companies report to the IRRC because we know about only the committee for companies that report.

RESULTS

Level of Environmental Officer

In Table 2, we regress several independent variables against the number of levels between the CEO and senior environmental officer. Because the dependent variable is available for only companies that report to the IRRC, our sample in this test is the 137 firms that report. Our independent

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Table 2

Regression Analysis Based on Company Level Data, Dependent Variable = Level of Environmental Officer to CEO[a]

	Intercept	*Number of Penalties*[b]	*Fines (% of Revenues)*[c]	*Industry Average Fines (% of Revenues)*[d]	*CompanyFines (% of Industry Average)*[e]	*Environmental Board Committee*[f]	*Adjusted* R^2 (F)
1	0.982	–0.004					0.00
	(10.52)****	(–0.96)					(0.92)
2	0.97		–0.001				0.01
	(11.83)****		(–1.59)				(2.52)
3	0.992			–0.001			0.00
	(10.83)****			(–1.24)			(1.54)
4	0.977				–0.035		0.00
	(10.06)****				(–0.74)		(0.55)
5	0.969					–0.059	0.00
	(7.97)****					(–0.37)	(0.13)
6	1.018	–0.003	–0.001	–0.001			0.00
	(10.18)****	(–0.61)	(–1.09)	(–0.50)			(1.08)
7	1.010	–0.004			0.028		0.00
	(9.62)****	(–0.84)			(–0.58)		(0.63)
8	1.043	–0.002	–0.000	–0.001		–0.046	0.00
	(7.73)****	(–0.53)	(–1.07)	(–0.53)		(–0.28)	(0.82)

Note: CEO = chief executive officer. The numbers in parentheses below the coefficients are the *t* statistics.

a. The Investor Responsibility Research Center (IRRC) reports (for companies that respond to its environmental questionnaire) the number of levels that the senior environmental officer is away from the CEO. A score of 0 implies that the officer reports directly to the CEO. A score of 1 implies that the senior environmental officer reports to someone who reports to the CEO, and so on.

b. The IRRC reports the number of criminal or civil/administrative penalties that the company was assessed in the years 1993 to 1995.

c. The IRRC computes for each company the sum of the dollar amount of environmental fines for 1993 to 1995 as a percentage of company revenues for the same time period. For the computation, the fines are in dollars, but revenues are measured in millions.

d. The IRRC reports fines as a percentage of revenues for the industry.

e. For each company, the IRRC presents the industry average of fines divided by revenues. Our variable is the company's fines as a percentage of revenue divided by industry average.

f. For companies that respond to the IRRC questionnaire, we are able to determine if a company's board of directors has a committee devoted to environmental concerns. When there is a committee, we score this variable as 1, and we score it 0 otherwise.

****$p < 0.001$.

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variables include number of penalties, fines as a percentage of revenues, the industry average of fines as a percentage of revenues, and the company fines as a percentage of industry fines. We also include the presence of an environmental board committee as an independent variable because boards typically hire, or at least approve the hiring of, senior executives.

The first five regressions are simple regressions of each variable. Regressions 6 to 8 contain various combinations of independent variables. We cannot include all of the independent variables simultaneously because of multicollinearity problems (see the correlation matrix in the appendix). None of these regressions has significant variables. The regulatory actions for company and industry are, in our sample, unrelated to the level in the corporate hierarchy of the environmental officer. These results do not support our first hypothesis.[1]

Reporting to IRRC

Table 3 contains the logit regression analyses for the dependent variable that takes a value of 1 if the company voluntarily reports its environmental data to the IRRC and takes the value of 0 otherwise. The independent variables include the number of penalties, fines as a percentage of revenues, industry average for fines as a percentage of revenues, and company fines as a percentage of industry fines.

Regressions 9 to 12 contain simple regressions for each of the independent variables. Regression 10 shows that the coefficient for fines as a percentage of revenues has a positive coefficient. This coefficient has a Wald statistic that is significant at the 0.10 level. Regression 12 shows that the coefficient for company fines (as a percentage of revenues) divided by industry fines (as a percentage of revenues) has a positive coefficient. The coefficient for this variable has a Wald statistic that is significant at better than 0.05. When we regress various combinations of independent variables, only the coefficient for company fines as a percentage of industry fines remains statistically significant, as shown in Regression 13.[2]

The positive coefficients and significance of these variables are consistent with our second hypothesis. Environmental regulatory action is associated with an increased likelihood that a company will report its environmental behavior and data. This means that when companies have been sanctioned for environmental problems, they appear more likely to want to change their image and report on their environmental initiatives.

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Table 3

Logit Regression Analysis: Dependent Variable[a] = 1 if the Company Reports Environmental Data and 0 Otherwise

	Intercept	*Number of Penalties*[b]	*Fines (% of Revenues)*[c]	*Industry Average Fines (% of Revenues)*[d]	*Company Fines (% of Industry Average)*[e]	R^2 *(Chi Square)*
9	0.3758	0.0081				0.006
	(5.65)**	(0.91)				(0.99)
10	0.3046		0.0049			0.033
	(3.87)**		(2.96)*			(5.58)**
11	0.3397			0.0026		0.011
	(4.44)**			(1.62)		(1.84)
12	0.2504				0.2264	0.034
	(2.40)				(4.69)**	(5.63)**
13	0.2205	0.0041			0.2151	0.035
	(1.64)	(0.24)			(4.12)**	(5.89)*
14	0.2634	0.0022	0.0044	0.0008		0.035
	(2.25)	(0.07)	(2.09)	(0.16)		(5.83)

Note: The numbers in parentheses below the coefficients are Wald Statistics.

a. The Investor Responsibility Research Center (IRRC) sends environmental questionnaires to *Fortune* 500 companies. In our sample of 224 firms, 13 returned the questionnaire and reported data about their environmental efforts. We score this variable a 1 if the company reports and a 0 otherwise.

b. The IRRC reports the number of criminal or civil/administrative penalties that the company was assessed in the years 1993 to 1995.

c. The IRRC computes for each company the sum of environmental fines for 1993 to 1995 as a percentage of company revenues for the same time period. For the computation, the fines are in dollars, but revenues are measured in millions.

d. The IRRC reports fines as a percentage of revenues for the industry.

e. For each company, the IRRC presents the industry average of fines divided by revenues. Our variable is the company's fines as a percentage of revenue divided by industry average.

$*p < 0.10$. $**p < 0.05$.

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Environmental Board Committee

Table 4 contains the logit regression analysis for the dependent variable taking the value of 1 if there is an environmental board committee and taking the value 0 otherwise. We use the same independent variables as in the previous table.

Regressions 15 to 18 are the simple regressions for each independent variable. In Regression 15, the coefficient for number of penalties is positive and has a Wald statistic that is significant at better than 0.05. In Regression 18, the coefficient for company fines as a percentage of industry fines is positive and has a Wald statistic that is significant at better than 0.10.

In the multiple regressions, the coefficient for number of penalties remains positive and significant. The signs of these coefficients are as we would predict and lend support to our third hypothesis.[3]

However, in Regression 20, the coefficient for the industry average of fines as a percentage of revenues has a negative coefficient that is significant at better than 0.05. This suggests that companies in industries with relatively greater fines (dirtier industries) are less likely to have an environmental board committee.

Size of Environmental Staff

Table 5 contains the regression results for the dependent variable that is the number of employees on the environmental staff. We use the same four independent variables as in the previous table, plus a dummy variable taking the value of 1 if there is an environmental board committee. None of these regressions produced significant results. Therefore, we find no results that support our fourth hypothesis.

Percentage of Facilities Audited

Table 6 contains the results for the regressions with the percentage of facilities audited operating as the dependent variable. The independent variables are the same as in the previous table.

Regressions 29 to 33 are the simple regressions for each independent variable. Only the coefficient for industry average of fines as a percentage of revenues is significant (in Regression 31). This variable remains significant in the multiple regressions. However, the overall F statistic for the multiple regressions is insignificant.

The coefficient for this variable is negative, and the t statistics in all of the regressions are significant at better than 0.05. The negative coefficient

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Table 4

Logit Regression Analysis: Dependent Variable = 1 if there is a Board Committee[a] for Environmental Policies and 0 Otherwise

	Intercept	*Number of Penalties*[b]	*Fines (% of Revenues)*[c]	*Industry Average Fines (% of Revenues)*[d]	*Company Fines (% of Industry Fines)*[e]	R^2 *(Chi Square)*
15	–0.0747	0.0379				0.071
	(0.11)	(4.94)**				(7.431)***
16	0.2663		0.0002			0.001
	(2.22)		(0.07)			(0.075)
17	0.3962			–0.0022		0.013
	(3.90)**			(1.31)		(1.367)
18	0.0505				0.2039	0.034
	(0.06)				(3.06)*	(3.464)*
19	–0.1880	0.0322			0.1433	0.085
	(0.61)	(3.75)*			(1.47)	(8.99)**
20	0.0476	0.0527	0.0005	–0.0053		0.117
	(0.04)	(6.50)**	(0.27)	(4.29)**		(12.496)***

Note: The number in parentheses is the Wald statistic.

a. For companies that respond to the Investor Responsibility Research Center (IRRC) questionnaire, we are able to determine if a company's board of directors has a committee devoted to environmental concerns. When there is a committee, we score this variable as 1, and we score it 0 otherwise.

b. The IRRC reports the number of criminal or civil/administrative penalties that the company was assessed in the years 1993 to 1995.

c. The IRRC computes for each company the sum of environmental fines for 1993 to 1995 as a percentage of company revenues for the same time period. For the computation, the fines are in dollars, but revenues are measured in millions.

d. The IRRC reports fines as a percentage of revenues for the industry.

e. For each company, the IRRC presents the industry average of fines divided by revenues. Our variable is the company's fines as a percentage of revenue divided by industry average.

*$p < 0.10$. **$p < 0.05$. ***$p < 0.01$.

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Table 5

Regression Analysis Based on Company-Level Data, Dependent Variable = Size of the Company Environmental Staff[a]

	Intercept	*Number of Penalties*[b]	*Fines (% of Revenues)*[c]	*Industry Average Fines (% of Revenues)*[d]	*Company Fines (% of Industry Average)*[e]	*Environmental Board Committee*[f]	*Adjusted* R^2 (F)
21	45.256	0.371					0.00
	(2.53)**	(0.43)					(0.19)
22	50.823		–0.024				0.00
	(3.21)***		(–0.37)				(0.14)
23	49.138			–0.003			0.00
	(2.79)***			(0.02)			(0.00)
24	55.953				–5.597		0.00
	(3.01)***				(–0.63)		(0.39)
25	24.085					44.300	0.01
	(1.04)					(1.45)	(2.09)
26	45.604	0.421	–0.033	0.023			0.00
	(2.36)**	(0.47)	(–0.46)	(0.12)			(0.13)
27	51.751	0.483			–6.497		0.00
	(2.57)**	(0.55)			(–0.71)		(0.35)
28	21.238	0.131	–0.039	–0.067		45.009	0.00
	(0.82)	(0.14)	(–0.54)	(0.35)		(1.41)	(0.60)

Note: The number in parentheses is the Wald statistic.

a. The Investor Responsibility Research Center (IRRC) reports the number of corporate employees engaged in environmental duties.

b. The IRRC reports the number of criminal or civil/administrative penalties that the company was assessed in the years 1993 to 1995.

c. The IRRC computes for each company the sum of environmental fines for 1993 to 1995 as a percentage of company revenues for the same time period. For the computation, the fines are in dollars, but revenues are measured in millions.

d. The IRRC reports fines as a percentage of revenues for the industry.

e. For each company, the IRRC presents the industry average of fines divided by revenues. Our variable is the company's fines as a percentage of revenue divided by industry average.

f. For companies that respond to the IRRC questionnaire, we are able to determine if a company's board of directors has a committee devoted to environmental concerns. When there is a committee, we score this variable as 1, and we score it 0 otherwise.

**$p < 0.05$. ***$p < 0.01$.

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Table 6

Regression Analysis, Dependent Variable = Percentage of Facilities Audited[a]

	Intercept	*Number of Penalties*[b]	*Fines (% of Revenues)*[c]	*Industry Average Fines (% of Revenues)*[d]	*Company Fines (% of Industry Average)*[e]	*Environmental Board Committee*[f]	*Adjusted* R^2 (F)
29	66.778	−0.099					0.00
	(19.55)****	(−0.06)					(0.36)
30	65.867		−0.003				0.00
	(21.82)****		(−0.21)				(0.04)
31	69.273			−0.068			0.027
	(20.96)****			(−2.17)**			(4.72)**
32	65.574				0.106		0.00
	(18.47)****				(0.06)		(0.00)
33	64.034					2.928	0.00
	(14.43)****					(0.50)	(0.25)
34	69.534	−0.035	0.012	−0.080			0.017
	(19.21)***	(−0.21)	(0.84)	(−2.24)**			(1.80)
35	66.478	−0.104			0.299		0.00
	(17.29)****	(−0.62)			(0.17)		(0.20)
36	68.615	−0.046	0.011	−0.078		1.697	0.011
	(14.04)****	(−0.27)	(0.82)	(−2.16)**		(0.28)	(1.36)

Note: The number in parentheses is the Wald statistic.

a. The Investor Responsibility Research Center (IRRC) reports the percentage of the firms audited in the preceding 2 years. For each firm replying to the IRRC, we obtain this percentage.

b. The IRRC reports the number of criminal or civil/administrative penalties that the company was assessed in the years 1993 to 1995.

c. The IRRC computes for each company the sum of environmental fines for 1993 to 1995 as a percentage of company revenues for the same time period. For the computation, the fines are in dollars, but revenues are measured in millions.

d. The IRRC reports fines as a percentage of revenues for the industry.

e. For each company, the IRRC presents the industry average of fines divided by revenues. Our variable is the company's fines as a percentage of revenue divided by industry average.

f. For companies that respond to the IRRC questionnaire, we are able to determine if a company's board of directors has a committee devoted to environmental concerns. When there is a committee, we score this variable as 1, and we score it 0 otherwise.

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suggests that in industries with relatively larger fines, the companies in the industry audit a smaller percentage of their assets. These results do not support our fifth hypothesis.

DISCUSSION AND CONCLUSION

Firms frequently spend between 1% and 2% of their revenues in response to environmental concerns (Medhurst, 1993), and environmental regulations and costs shape strategic decisions in areas such as managing energy and wastes, sourcing raw materials, and locating production facilities (Smart, 1992). We examined subsequent organizational structural responses to fines and penalties associated with environmental regulation noncompliance.

Two of the five environmental management infrastructure and practice variables we examined were found to be associated with environmental noncompliance fines and penalties. Both the likelihood of reporting environmental policies and activities and the likelihood of having a separate board of directors' committee that monitors company environmental policies were linked to environmental fines and penalties. Fewer intervening reporting levels between the senior environmental officer and the CEO, high environmental staffing levels, and audit of a greater proportion of firm facilities, however, were not associated with the magnitude of the fines and penalties.

The two significant variables are the likelihood of reporting and having a separate board of director committee, and these may be related. Both variables are visible activities. Increased reporting and establishment of a board environmental committee may have been done by companies with large fines to demonstrate to external stakeholders that the company is taking systematic steps to alleviate its environmental troubles. On the other hand, management's logic for changing these two variables may be that the board committee gives the impression that environmental policies receive very high level attention. Environmental reporting may give the impression that the company has nothing to hide. The three insignificant variables, reporting levels to the CEO, higher staff levels, and audit of facilities, are perhaps more internally focused and less visible. Management may choose the more visible actions first to satisfy external stakeholders.

Our results are somewhat consistent with those in Stead et al. (1998). Those authors find that firms in high polluting industries are making progress but have not apparently done enough. Their analysis is based on a review of case law in the environmental arena.

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One caveat to our results is that the infrastructure changes may require a longer time lag after the fines and penalties have been levied. Thus, after a longer time lag, we may observe greater infrastructure changes of a wider variety. Future research can be directed at this issue.

These findings suggest that although environmental regulatory pressures may serve as major drivers of managerial environmental action (Henriques & Sadorsky, 1996; Rugman & Verbeke, 1998), they alone may be insufficient determinants of comprehensive environmental management infrastructures and practices. This is consistent with the broader notion of proactive environmental management being influenced not only by government pressure but also by other forces from stakeholders such as competitors, employees, customers, and shareholders (Berry & Rondinelli, 1998). These results may also suggest that the current regulation is ineffective in causing organizations to institutionalize environmentally friendly infrastructures.

Post and Altman (1992) argued that corporate greening first starts as an adjustment on an "as needed" (p. 22) basis, which may be prompted by regulatory pressure. The second phase of greening is adaptation in which a corporation begins to change its values. Here, we would argue, is where infrastructure changes would begin. Our results suggest that regulatory fines and penalties may be only marginally effective in moving companies into the adaptive stage of greening. Whereas a firm's natural environment posture may be determined in part by traditional corrective measures driven by regulatory pressures, the establishment of a more extensive and preventive environment management program may well be more voluntary, "adopted on a firm's own initiative, as a result of a growing awareness of problems and perceptions of advantages" (Aragon-Correa, 1998, p. 557).

Furthermore, the radicalness of the firm's structural innovation response to the noncompliance fines and penalties will likely depend on whether the regulatory pressures are perceived as threats or opportunities (Sanchez, 1997). Consistent with the threat-rigidity literature (Jackson & Dutton, 1988; Staw, Sandelands, & Dutton, 1981), if environmental noncompliance fines and penalties are viewed as threats, managers may respond with resistance and rigidity, which inhibit the development of more innovative and comprehensive structural responses. Having a board-level environmental committee and reporting environmental policies are two relatively low-cost ways of responding to such perceived threats.

In addition, the magnitude of the fines and penalties may not have been judged sufficient to motivate the firm to implement broader changes in the environmental management infrastructure. The regulatory financial pressure may simply not have been seen as enough to justify a more extensive

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overhaul of the internal environmental management system. Interactions with external stakeholders via an existing and more streamlined internal structure may have been seen as sufficient and cost-effective, at least in the short run.

An important limitation of our study is that we relied upon data supplied to the IRRC. Therefore, any conclusions drawn relate to the levels of firm environmental infrastructure activity reported to the IRRC. About 60% of firms that produced their own environmental reports do not adjust data for performance levels; only 33% report environmental bad news, and just 15% provide data verified by a third party ("Environmental Annual Reports," 1998). As one of the few sources for standardized environment management data, however, the IRRC profiles contain normalized information, which is a significant step ahead of that contained in typical company environmental reports.

One question that our data limitations do not let us examine is whether changes to the corporate environmental infrastructure result in better environmental compliance and performance. This is, ultimately, the key question. Future research should be directed at this issue.

Future research should also continue to explore the influence of noncompliance fines and penalties as well as other forces on environmental management infrastructures. Whether the impetus for environmental management is regulatory pressure, profitability concerns, or enhanced public relations, the role of the corporate environmental management function is transitional, with more of the responsibility for carrying out environmental activities likely falling to core functions throughout the firm. Just as the drives for quality and for profits have largely disappeared into the cultural foundations of the firm, environmentalism may also become implicit in the organizational structure (Hoffman, 1997). The development and implementation of a corporate environmental management infrastructure and culture is becoming an integral part of overall corporate strategy.

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APPENDIX
Correlation Coefficients

Panel A: Independent Variables

	Company Fines (% of Revenues)	*Industry Fines (% of Revenues)*	*Company Fines (% of Industry Fines)*	*Number of Penalties*
Company fines (% of revenues)	1.000	0.425***	0.467***	0.176**
Industry fines (% of revenues)		1.000	0.001	0.224**
Company fines (% of industry fines)			1.000	0.197**
Number of penalties				1.000

Panel B: Dependent Variables

	Percentage of Facilities Audited	*Board Environmental Committee*	*Levels to CEO*	*Number of Environmental Staff*
Percentage of facilities audited	1.000	0.040	–0.122	0.055
Board environmental committee		1.000	–0.048	0.124
Levels to CEO			1.000	0.111
Number of environmental staff				1.000

Note: CEO = chief executive officer.

Panel C: Independent Versus Dependent Variables

	Percentage of Facilities Audited	*Board Environmental Committee*	*Levels to CEO*	*Number of Environmental Staff*
Company fines (% of revenue)	–0.019	0.023	–0.139	–0.032
Industry fines (% of revenue)	0.005	0.154	–0.074	–0.054
Company fines (% of industry)	–0.185**	–0.100	–0.113	0.002
Number of penalties	–0.053	0.203**	–0.088	0.037

**$p < 0.05$. ***$p < 0.01$. ****$p < 0.001$.

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NOTES

1. We tested this hypothesis in an alternate way, using ANOVA. As shown below, we computed the mean for the four independent variables for each group of firms with *i* levels between the chief executive officer (CEO) and environmental officers where *i* is an integer ranging from 0 to 6.

	Levels to CEO for the 137 Firms Reporting to Investor Responsibility Research Center							
	0	*1*	*2*	*3*	*4*	*5*	*6*	*Seven-Group ANOVA* F *Statistic*
Frequency	47	59	26	3	1	0	1	
Percentage of total	21.0	26.3	11.6	1.3	0.4	0.0	0.4	
Company fines (% of revenues)	117.97	36.97	34.30	8.39	0.35		0.34	0.786
Industry fines (% of revenues)	1.46	1.08	1.02	0.28	0.11		3.09	0.818
Company fines (% of industry fines)	58.10	59.11	34.68	22.88	3.15		0.11	0.468
Number of penalties	12.02	11.76	7.85	8.00	1.00		7.00	0.296

For company fines as a percentage of revenues, we see a monotonic relationship between the group mean, where the group is the number of levels to the CEO. When there are no levels between the two managers, the average is 117.97%. This average drops as the number of levels increases. However, the *F* statistic is only 0.786, which is statistically insignificant. Because there are so few cases of three or more levels between the two managers, we dropped them from consideration and reran the results with a 3-group ANOVA. The results remain statistically insignificant. Similarly, the ANOVAs for the other three variables are insignificant as well.

2. In other tests, we directly compared the means of the four independent variables based on whether or not a company reports to the Investor Responsibility Research Center. In this comparison, we used a two-sample *t* test. The results appear below.

	Do Report	*Do Not Report*	t *Statistic*
Number of penalties	10.912	8.529	0.97
Company fines (% of revenues)	63.090	21.174	2.03*
Industry fines (% of revenues)	52.492	38.289	1.45
Company fines (% of industry fines)	1.189	0.684	2.35*

Our results show that the sample means for company fines as a percentage of revenue are 63.09% for reporting firms and only 21.174% for nonreporting firms. The *t* statistic is 2.03, which is significant at better than 0.05. The means for company fines as a percentage of industry fines are 1.189 for reporting firms and 0.684 for nonreporting firms. The *t* statistic is 2.35, which is significant at better than the 0.05 level. For the industry average of fines as a percentage of revenues and for the number of penalties, the means are nominally larger for reporting firms, but these tests produced statistically insignificant *t* statistics.

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3. In other tests, we compare the means of the four independent variables for the group of firms with an environmental board committee and for the firms without this committee. The results appear below.

	With Committee	*Without Committee*	t *Statistic*
Number of penalties	14.051	6.763	2.65**
Company fines (% of revenues)	67.829	56.825	0.28
Industry fines (% of revenues)	44.522	63.029	−1.11
Company fines (% of industry fines)	1.418	0.886	1.88†

These results support the simple regressions. The mean for number of penalties averages 14.051 for firms with an environmental board committee and is only 6.763 for firms without this committee ($t = 2.65$, significant at better than 0.01). The coefficients for company fines as a percentage of industry fines are 1.418 for firms with and 0.886 for firms without an environmental board committee ($t = 1.88$, significant at better than 0.01). The means for the other two variables are statistically insignificant.

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