Adopting ISO 14001:
Why Some Firms Mandate Certification while Others Encourage It

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November 2001

Paper for presentation at the Twenty-Third Annual Research Conference for the Association for Public Policy Analysis and Management Fall Conference: "Public Policy Analysis and Public Policy: Making the Connection," November 1-3, Washington Monarch Hotel, Washington, DC.

Abstract

Since 1996 hundreds of U.S. facilities have certified their environmental management systems (EMS) to ISO 14001. While EMS certification occurs at the facility level, little is known about how parent companies influence facility-level certification, and even less is known about what factors are more influential to the corporate-level decisions than others. This study begins to understand these issues. It shows that approximately half of the U.S. companies have required ISO 14001 in their facilities, divisions, or subsidiaries. In making their corporate-level decisions, firms that mandated ISO 14001 were more motivated by regulatory and market pressures, and had stronger overall internal capabilities than did firms that merely encouraged ISO 14001. Indeed, there was no single case where firms with less rigid corporate ISO 14001 policies endured stronger external pressures and possessed greater internal capabilities prior to making their corporate decision. These results have important implications for public policy as most government sponsored incentives for EMS adoption are designed for facility participation rather than firm involvement, despite the fact that firms appear to have substantial influence on facility-level decisions. Moreover, because these firms demonstrated greater internal management proficiencies government incentives that attempt to bolster their internal competencies had less effect than did market pressures and compliance pressures, which alone may motivate publicly traded firms to develop corporate policies for ISO 14001.

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Introduction

In recent years researchers of business management, economics, and public policy, in addition to regulators, have given increasing attention to the benefits that organizations derive from behaving in an environmentally proactive manner. Among other things, organizations may improve their operational efficiencies, reduce their long-term liabilities, and gain competitive advantage. As part of this process, some firms have begun to either encourage or require that their operational units certify their environmental management systems (EMS) to ISO 14001. This occurrence is particularly interesting because organizations that mandate ISO 14001 registration see greater value in the standard than do organizations that merely encourage it. Little is known, however, about the firms' corporate policies on ISO 14001 in large part because ISO 14001 was only recently created in 1996 and less than 160 U.S. parent companies have implemented it.[2]

Despite its recent beginnings, ISO 14001 has the potential to be utilized by a significant number of organizations, as the standard does not target specific industries or companies. In fact, any organization can adopt an ISO 14001 EMS, as long as it fulfills the standard's goals and receives third party certification. Because of its broad applicability, ISO 14001 is particularly attractive to regulators, because if the standard assists firms in achieving their regulatory objectives less oversight may be needed and EPA can more readily achieve its environmental protection goals. This potential has motivated states and EPA to offer firms incentives to implement EMSs through its EMS Pilot Program and Performance Track Program. Since the effectiveness of these programs depends in large part on how organizations respond to them, it is important for regulators to understand the factors that motivate EMS adoption and certification, as doing so will assist them in encouraging firms to broaden their environmental consideration, thus increasing the likely success of the programs themselves. Moreover, as regulators increasingly expand their basket of market-based voluntary programs, it will be important for them to understand which organizations are more likely to utilize the standard so that they are better able to target specific industries and firms of interest.

While studies on ISO 14001 are limited, progress has been made to understand firms' decisions to change their environmental strategies or to participate in a voluntary environmental program. These studies suggest that multiple external factors (Arora and Cason, 1996; King and Lenox, 2000; Welch, Mazur and Bretschneider, 2000; Darnall, 2002; Khanna and Damon, 1999) and internal capabilities (see for example Cordano and Frieze, 2000; Rugman and Verbeke, 1998; Sharma, 2000; Russo and Fouts, 1997; Welford, 1992; Egri and Herman, 2000; Sharma and Vredenburg 1998; Darnall, 2002; Andersson and Bateman, 2000; Klassen 2000; Hart 1995, 1997; Christmann, 2000; Florida, 1996) play a role, although both factors are rarely evaluated together (Darnall, 2002; Oliver, 1997). Applied to a firms' corporate level policies on ISO

[2] By April 2000, these 160 organizations accounted for approximately 972 ISO 14001-certified facilities.

14001, a deeper understanding of these factors seems key in explaining whether they mandate their operational units to employ the standard or not.

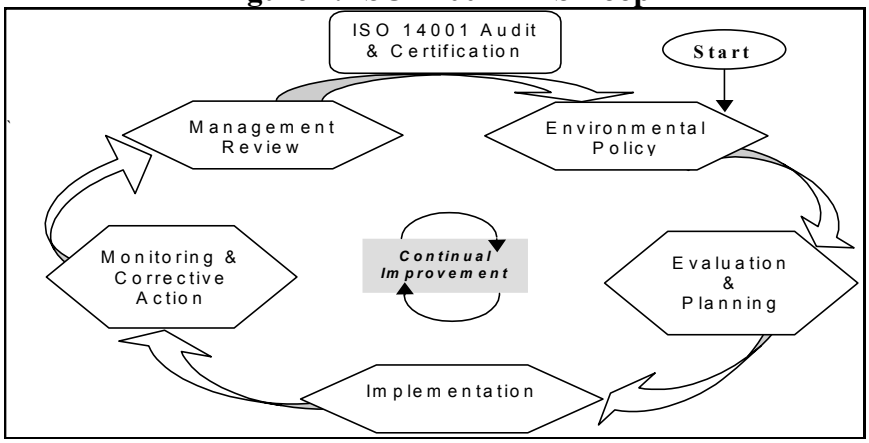
This paper addresses these issues by taking an integrative approach. The first half describes ISO 14001, its potential value for public policy, and how it builds on existing capabilities that the organization develops over time. It then explores both the external and internal factors that comprise different organizations' ISO 14001 mandate decisions, using both institutional theory and the resource-based view of the firm (RBV) to explain a framework for corporate-level ISO 14001 decisions. The second half explains the research methods used to test the differences between corporate-level decisions to mandate or encourage ISO 14001 in their operating units. Using survey data, these differences are tested empirically. The paper ends with a discussion of the theoretical and public policy implications of this research.

The ISO 14001 Context

ISO 14001-certified EMSs are standards for environmental management. Developed by the International Organization for Standardization (ISO), a Geneva-based NGO that promotes the development and implementation of international standards, ISO 14001 focuses on EMS standardization and certification. While many companies have employed EMSs for years, ISO 14001 is the first attempt to create an international EMS standard that is certified by an external auditor.

ISO 14001 is based on Shewhart's (1931) "Plan, Do, Check, Act" model[3] towards achieving continuous improvement. By using this framework, organizations systematically consider their environmental aspects and impacts by taking into account five broad factors: an environmental policy, evaluation and goal setting, implementation, monitoring and corrective-action procedures, and management review. The goal of processing through each step of the cycle is to achieve lower environmental impact of goods, products, services, or information. It is represented graphically as a circle or wheel (see Figure 1) because it involves repeating the same steps over and over in a continuous effort to improve operational processes. Firms which certify to ISO 14001 have independent external auditors review and verify their EMS to make sure that it conforms to the these five broad factors.

Figure 1: ISO 14001 EMS Loop



ISO 14001 EMSs are principled on a highly systematic framework that at a basic level focuses on various environmental strategies which minimize waste and prevent pollution. These strategies are people intensive, and depend upon tacit skill development through employee involvement (Cole, 1991; Lawler, 1986; Hart, 1995; Sharma and Vredenburg, 1998) and work in teams (Makower, 1993; Willig, 1994; Hart, 1995). They also rely on substantial internal evaluation, monitoring, knowledge development, and improvement of operational factors (Hart, 1995).

At a more advanced level, ISO 14001 EMSs have the potential to move organizations towards embracing product stewardship principles and utilizing life-cycle cost analysis. In doing so, ISO 14001 may help firms to better scrutinize the environmental impact of their supply chain (Sarkis and Kitazawa, 2000), and develop closer working relationships with staff, thus elevating environmental concerns throughout the organization (Shrivastava, 1995; Hart, 1995). If organizations consider jointly all aspects of their organizational system, this awareness also helps to prevent the shifting of environmental harm from one subsystem to another (Shrivastava, 1995). Such management practices, however, require proficiencies in transferring knowledge and generating momentum among human resources to proactively manage their environmental harms. They also require an ability to push strategic initiatives deep into the organization's learning systems to create congruence across the strategic, structural, and learning systems to ensure environmental sustainability (Jennings & Zandbergen, 1995). All of these factors combined assist firms to achieve greater organizational efficiency (Hart, 1995; Lawrence & Morell, 1995; Welford, 1992; Roome, 1992) and are crucial for achieving proactive environmental change (Lawrence & Morell, 1995). They are also critical in assisting firms to maintain or gain competitive advantage (Hart, 1995).

Despite its apparent focus on business operations, ISO 14001 also has gained the attention of public policy makers because of its potential relevance to environmental protection. Since the late 1990s, state and federal environmental regulators have investigated the use of EMSs and their role in public policy. One outgrowth of this interest is the formation of the Multi-state Working Group on Environmental Management Systems (MSWG), which in concert with EPA initiated ten state-level pilot programs to encourage and facilitate EMS adoption in approximately 60 U.S.-based facilities. The MSWG and EPA initiated the pilot program to determine the potential EMSs have for future regulation. Approximately three-quarters of the pilot facilities are also seeking ISO 14001 certification.

Since the pilot program began, regulators' interest in EMSs has gained momentum and in 2000, EPA created Performance Track to recognize organizations that consistently meet their legal requirements and implement high-quality environmental management systems based on the ISO 14001 framework. Regulators' interest in EMSs is rooted in the belief that organizations which adopt EMSs may meet or exceed their regulatory commitments, thus making the environmental regulatory system less applicable to them. While evidence on this issue is not yet available, if EMSs are shown to increase environmental performance then important questions arise about whether EPA should use ISO 14001 as a tool to help the agency achieve its goals of greater environmental protection

[3] Deming (1986) later modified this framework into the "Plan, Do, Study, Act" cycle.

There are multiple factors that affect firms' decisions to adopt an EMS and certify it to ISO 14001. These factors can be categorized into external drivers or pressures for environmental change and the internal capabilities that the organization possesses prior to EMS adoption, and which serve as a foundation to implement ISO 14001. Both of these factors are described further in the following sections as they relate to a corporation's decision to mandate or encourage ISO 14001 certification in its operational units.

External ISO 14001 drivers

External drivers comprise all factors outside an organization that influence its routines and competencies (Aldrich, 1999) and motivate it to mandate ISO 14001. While multiple theories have emerged that define the factors shaping organizational change, DiMaggio and Powell's (1983) framework has gained substantial prominence in organizational studies. The authors suggest three types of external pressures (coercive, mimetic and normative) that shape organizational change towards homogeneity.

Coercive pressures are the formal and informal forces exerted on organizations by institutions that they are dependent on. Mimetic behaviors arise because of the belief that organizations should model themselves to other enterprises. Finally, normative behaviors are related to professionalism, and are a result of networks such as industry associations and educational processes. While coercive pressures often dominate organizational change, when professional networks are formalized these normative pressures can have substantial influence, too (DiMaggio and Powell 1983).

Building on DiMaggio and Powell's framework, recent studies have considered this neo-institutional paradigm by examining the motivators for organizations' environmental change. They suggest, for example, that regulatory pressures influence organizations' environmental actions (Henriques and Sadorsky, 1996, 1999; Hart, 1995; Jaffe et al., 1995; Hoffman, 2000; Khanna and Damon, 1999; Porter and van der Linde, 1995; Welch, Mazur and Bretschneider, 2000; Arora and Cason, 1996). These pressures come in various forms and include coercive mandates to adopt specific control technology, apply for operating permits, monitor and report on its media-specific environmental discharges, allow regulator audits of their environmental activities and address any emissions violations, potential violations or legal implications of non-compliance. To the extent that organizations can influence the formation of regulation, managing their environmental impacts may serve as a signal to lawmakers to either increase restrictions for industry as a whole (Salop and Scheffman, 1983) or to preempt more stringent environmental regulation (Welch, Mazur and Bretschneider, 2000; Lutz, Lyon and Maxwell, 2000). There may also be normative regulatory benefits from certifying to ISO 14001, including increased recognition by government officials and improved relations with regulators.

Regulatory pressures are also taking on a new shape as EPA expands the number of its voluntary environmental programs (VEPs). Increasingly the agency is offering technical assistance grants as incentives for organizations to participate in VEPs and achieve EPA's regulatory goals (Davies et al., 1996). The MSWG's EMS Pilot Program and EPA's Performance Track are two such programs. Both programs encourage EMS adoption by offering participants technical assistance, public recognition, and potential regulatory benefits as incentives for participation. While still operating as an institutional pressure, these regulatory

incentives are less coercive than is the traditional regulatory regime, and as such may lead to greater variation in organizational responses (Jennings and Zandbergen, 1995).

Prior literature also emphasizes the importance of market pressures on organizations' environmental change (Arora and Cason, 1996; Hoffman, 2000; Bowen, 2000; Khanna and Damon, 1999; Konar and Cohen, 1997). Market pressures refer to the interplay of all potential buyers and sellers involved in the production, sale or purchase of a particular commodity or service. Markets include consumers, customers and competitors who are influencing companies to proactively manage their environmental management strategies (Hoffman, 2000). As information has become more readily available about companies' environmental activities, customers and firms have increasingly considered the environment when making their purchasing decisions (Arora and Gangopadhyay, 1995; Marshall and Mayer, 1991). Some firms, for example, seek only to do business with factor suppliers that have certified their EMSs, as doing so helps to ensure that their final product is more environmentally conscious (Bowen, 2001; Darnall, Gallagher and Andrews, 2001; Darnall et al., 2000). By adopting ISO 14001, suppliers may better satisfy these market demands.

Finally, social pressures also influence organizations' environmental actions (Klassen and McLaughlin, 1996; Henriques and Sadorsky, 1996, 1999; Arora and Cason, 1996; Konar and Cohen, 1997; Welch, Mazur and Bretschneider, 2000; Garrod and Chadwick, 1996; Hoffman, 2000). These pressures are derived from an organization's external constituents that must be actively managed in order to develop effective and successful operating strategies (Hoffman, 2000). Constituents include environmental groups, citizens groups and the media, and can mobilize public sentiment, alter accepted norms and change the way people think about the environment and the role of the organization in protecting it (Hoffman, 2000). Social drivers have gained increasing attention since the 1980s due to the heightening influence of stakeholders on organizational strategy (see for example, Klassen and McLaughlin 1996; Henriques and Sadorsky 1996, 1999; Arora and Cason 1995; Konar and Cohen 1997; Welch, Mazur, and Bretschneider; Garrod and Chadwick 1996; Hoffman 2000; Muoghalu, Robinson and Glascock 1990; Hamilton 1995). Part of this changing focus may be due to highly publicized stories of catastrophic environmental disasters like the nuclear accident at Three Mile Island, the Union Carbide toxic gas leak in Bhopal, and the Exxon oil spill, which has personalized the importance of organizations' environmental management activities (Rajan, 2001).

The basic premise of all of these institutional views is that organizational tendencies toward conformity with external influences lead to *homogeneity* among organizational behavior (Oliver, 1997). The organization is thus cast as a passive participant that responds to external pressures and expectations. This view is criticized, however, by researchers who argue that organizations are dynamic and evolving, and can respond to external pressures in a variety of ways based on the resources and capabilities that they posses (Oliver, 1997; Perrow, 1985). As such, an understanding of organizations' prior internal capabilities is also important in examining the rationales for changes in firms' environmental strategies.

Internal ISO 14001 drivers

RBV suggests that external factors, while important in shaping organizational strategy, cannot alone lead to competitive advantage (Barney, 1986). Instead, an organization's competitive strategies depend significantly on firm-specific capabilities (Sharma and

Vredenburg, 1998) and its ability to put these proficiencies to routine productive use (Grant, 1991; Collis and Montgomery, 1995; Russo and Fouts, 1997). These capabilities include less tangible knowledge-based advantages such as socially complex organizational processes and reputational assets (Barney, 1991; Rumelt, 1984; Penrose, 1959; Wernerfelt, 1984; Oliver, 1997) and are necessarily path dependent in that they are a function of unique organizational actions and learning that accrue over a period of time (Barney, 1991; Hart, 1995).

Applied to the environmental context, RBV informs why enterprises change their environmental strategy to consider ISO 14001 certification. Recent literature can be categorized into two frameworks. The first framework consists of studies that focus on "leadership capital" as capabilities that foster environmental action. This framework emphasizes the importance of managerial attitudes and views (Cordano and Frieze, 2000; Sharma, 1997; Sharma and Nguan, 1999), managerial interpretations (Sharma, 2000), environmental values and leaders (Egri and Herman, 2000) and environmental champions (Andersson and Bateman, 2000). In each of cases key individuals assist in creating a corporate culture that influences organizational decisions and explains in part why organizations engage in particular environmental activities. Such cultures are a function of the values and beliefs that lie at the core of an organization's social system and give rise to a set of management practices that are usually rooted in the values of the organization (Denison, 1990). A firm's culture is in large part a function of its leadership (Schein, 1992). Because mandating ISO 14001 may require substantial investments in capital and human resources, a firm's leadership and its resulting cultural influences affect its ability to initiate the management practice required to implement a corporate-wide ISO 14001 certification. Should these investments conflict fundamentally with the firm's philosophy of doing business, it will be less likely to undertake such an endeavor.

A second framework focuses on "higher-order learning processes" as capabilities, which are triggered by environmental responsiveness (Sharma and Vredenburg, 1998; Hart 1995; Christmann, 2000) and continuous improvement strategies (Hart, 1995; Russo and Fouts, 1997; Florida, 1996; Rugman and Verbeke, 1998; Sharma and Vredenburg, 1998). This framework focuses on actual management practices and suggests that in order to achieve higher-ordered learning proficiencies and capabilities, basic capacities must first be in place (Hart, 1995; Christmann, 2000). When considering an organization's decision to implement pollution prevention technologies, for example, it often must first change its existing production processes or product designs (Chistmann, 2000). Similarly, to achieve higher-order environmental changes (such as product stewardship) an organization must first be proficient in lower-order environmental capabilities (such as pollution prevention) (Hart, 1995). Organizations that adopt pollution strategies without basic-level competencies lack the capabilities to support them and are less likely to achieve their organizational goals (Christmann, 2000).

This discussion suggests that successful adoption of higher-order environmental practices, such as ISO 14001, require substantial investments in process innovation (Christmann, 2000). Firms that invest in developing these capabilities may also be more inclined to allocate resources towards ISO 14001 because the marginal cost of doing so is likely to be less than for firms who lack similar capabilities (Florida, 1996; Christmann, 2000). One reason for this is that firms that have developed their internal resources and social structures to encourage innovative management may also be more creative in addressing environmental costs and risks (Florida,

1996). These capabilities will become increasingly important as firms move closer to 'zero pollution,' as environmental improvements will become more technology and capital intensive.

While developing 'foundational' proficiencies are necessary to lead to competitive advantage, they are not sufficient. Competitors will over time replicate effective learning systems (Sharma and Vredenburg, 1998), and for this reason organizational competencies must be continually improved (Sharma and Vredenburg, 1998; Russo and Fouts, 1997; Hart, 1995) in order to generate a stream of innovations and achieve competitive advantage (Sharma and Vredenburg, 1998). Organizations that possess continual improvement processes, moreover, are more competent at transferring general basic capabilities and generating momentum to encourage commitments in environmental management (Klassen, 2000; Hart, 1995), and proactive environmental change (Lawrence and Morell, 1995; Florida, 1996).

The two RBV perspectives—the 'human capital' and the 'higher-order learning process'—are complements in that organizational leaders are likely to champion the basic organizational activities that are embedded in the more sophisticated environmental action, which the second framework describes. Within these frameworks, corporate culture, continuous improvement capabilities, investments in innovative technologies and capital, and environmental management capabilities all emerge as factors that may affect a firm's decision to mandate or encourage ISO 14001 registration.

Framework for Corporate ISO 14001 Policies

Together institutional theory and RBV suggest that both external and internal factors influence a firm's decision to mandate or encourage ISO 14001 certification. The combination of these two factors is likely to lead to different organizational decisions about ISO 14001. Enterprises that have acquired greater degrees of internal capabilities have greater capacities throughout each of their operational units. As a result, these firms possess the ability to centralize their environmental strategies, and have greater assurances that their operational units will implement corporate directives because they possess the knowledge, skills, and proficiencies to do so.

Confronted with external pressures for environmental consideration, firms with stronger internal capabilities are also better able to respond to them through adaptation. When faced with pressures to implement ISO 14001, for example, these firms will more likely adapt by exercising a corporate mandate for certification rather than merely allowing its operational units to adopt ISO 14001 on their own. This more direct corporate role can be achieved because the corporation has greater certainty that its operational units have the internal capabilities to successfully support such a system.

In contrast, firms that have weaker internal capabilities are be less likely to institute corporate directives for ISO 14001, as a mandate would likely receive resistance during implementation. This resistance is in part due to the fact that firms with weaker internal capabilities do not possess the basic competencies to implement ISO 14001 organization-wide. Confronted with fewer external pressures for environmental consideration, these firms also have fewer incentives to institute a corporate directive for ISO 14001, and as such will are less likely to mandate ISO 14001.

Hypothesis: Firms that mandate ISO 14001 in their operational units (mandaters) have stronger external pressures and greater internal capabilities than do firms that allow or encourage their operational units to certify on their own (encouragers).

Methodology

The first step in testing this hypothesis was to obtain a list of ISO 14001-certified facilities. Global International Quality Group (GIQ) maintains the most comprehensive list and as of July 2000 had identified 916 certified facilities that operated in the U.S. McGraw-Hill compiles a similar list, although it is less comprehensive. Both lists were obtained, merged, and duplicate records were removed.[4] In addition, the websites of state environmental departments were searched for other ISO 14001 facilities in each state. A total of 972 unique facilities were identified that had certified to ISO 14001 by April2000.

In order to determine the parent companies of these facilities, each facility was investigated in Dun & Bradstreet's *Who Owns Whom 2000/01, Volume 2* and *Hoover's Online*. These resources contain information on all facilities, divisions, and subsidiaries that operate in the U.S. and belong to publicly traded corporations. Parent companies were identified for 906 of the 972 facilities (557 U.S.-owned and 348 foreign-owned), as shown in Table 1. The unidentified owners of the 66 remaining facilities are believed to be private companies of either U.S. or foreign ownership. The 557 U.S. facilities were owned by 156 parent organizations.

Table 1: ISO 14001 Certified Organizations Operating in the U.S.

Organization Type	Unique Parent Orgs.	Percent of U.S. Total Orgs.	ISO 14001 Certified Facilities*	Percent of U.S. Total Facilities
• Int'l Incorporated (Publicly Traded)	128 (42%)	—	348 (36%)	—
• U.S. Owned				
a) U.S. Incorporated (Publicly Traded)	138 (49%)	88%	540 (56%)	97%
b) U.S. Privately Owned	11 (4%)	7%	11 (1%)	2%
c) U.S. Government	7 (3%)	5%	7 (1%)	1%
• Unidentified Organizations	—	—	66 (7%)	—
Total Certifications	***284***	***100% (174)***	***972***	***100% (558)***

* Does not sum to 100% because of rounding.

For comparability, two restrictions were imposed on the population. First, only publicly traded firms were included in this study, which eliminated the 17 private and government organizations. To confine the analysis to typical manufacturing firms and power generation and distribution operations, only firms within SIC codes 1000-4999 were included. This constraint eliminated three additional organizations. The remaining 138 firms are comprised of 91 Standard & Poor's (S&P) 1500 (Fortune 500, 400 Midcap, and 600 Smallcap) and 44 non-S&P 1500 firms, which are smaller publicly traded firms. The 91 S&P 1500 firms accounted for 87 percent (471) of all U.S. ISO 14001 certified facilities whose parent companies could be identified, as shown in Table 2.

[4] GIQ's data were for 1996-July 2000; McGraw-Hill's data were for 1996-1998.

Table 2: U.S. Incorporated Publicly Traded ISO 14001-Certified Firms

Firm Type	Unique Parent Companies	ISO 14001 Certified Facilities
• S&P 1500	91 (66%)	472 (87%)
• Dropped S&P 1500	3 (2%)	13 (2%)
• Non-S&P1500	44 (32%)	55 (10%)
TOTAL	138 (100%)	540 (100%)

Each parent company had at least one facility that was certified to ISO 14001 by April 2000. These companies were assumed to have one of two corporate policies on ISO 14001—either they mandated their operational units to adopt ISO 14001 or not. Firms that had in place corporate mandates are called "mandaters." Those organizations whose operational units were certified to ISO 14001 on their own in the absence of a corporate mandate, have a corporate culture or organizational structure that encourages facilities to certify despite their lack of corporate directive, and are thus called "encouragers." Some of these latter firms actively encouraged their operational units to certify to ISO 14001 while others left the decision entirely to the unit managers. The degree to which active encouragement occurred is unknown, however, which is why both types of firms are combined.

To determine which firms had corporate mandates and which did not and how external pressures and internal capabilities influenced their corporate-level ISO 14001 policies, all 135 firms were surveyed. The instrument was based on questions in the National Database on Environmental Management Systems' (NDEMS) data collection protocols.[5] Prior to their use in this study the instruments were modified to accommodate a firm-level analysis and then were pilot tested. Mail surveys were sent to each firm's corporate environmental director. Follow-up surveys were sent three weeks later, after which time, nonresponding firms were then sent up to five follow-up surveys through email. The response rate was 39 percent (53).

External driver measures. Three aggregate external drivers were measured–regulatory, market, and social drivers. Regulatory drivers were measured using a three-point ordinal scale (high influence, moderate influence, low influence) to determine why firms choose to mandate or encourage ISO 14001 and whether they believed that doing so (1) would improve their compliance with environmental regulations, (2) may lead to regulatory benefits in the future, (3) was attractive because of government assistance programs[6] that aided EMS development.

Market drivers were measured by eleven variables. Firms reported using the same three-point ordinal scale whether they mandated ISO 14001 or encouraged it because they believed that EMS adoption (1) was being pressured by domestic customers, (2) was being pressured by international customers, (4) was being pressured by domestic suppliers, (4) was being pressured by international suppliers, (5) was being pressured by shareholders, (6) may be rewarded by insurers, (7) may be a valuable marketing tool, (8) might reduce their costs, (9) might increase their revenues, (10) may provide a competitive advantage, (11) was increasingly being supported by environmental management professionals.

[5] Information on NDEMS and the data collection protocols can be found at www.eli.org/isopilots.htm.
[6] Government assistance programs included small grants for EMS development, pollution prevention assistance, EMS related workshops, and other state-assisted support.

Social drivers were the last category of external drivers considered and were measured by whether the firms believed that (1) outside interested parties were pressuring them to certify to ISO 14001 and whether (2) ISO 14001 may be a valuable public relations tool. Responses were elicited using the same three-point ordinal scale.

Internal capability measures. Four aggregate internal capabilities were measured—continuous improvement capabilities, environmental management capabilities, technology and innovation, and corporate culture. To measure firms' continuous improvement capabilities, firms were asked whether they had implemented either mandated or encouraged ISO 9000 quality management systems in their operational units or neither. This variable was coded 3 if mandate, 2 if encourage, and 1 otherwise.

Firms' environmental management proficiency was measured by whether or not prior to ISO 14001 decision they had (1) established a corporate-wide pollution prevention plan or required their operating units to implement their own pollution prevention plan, (2) encouraged that their operational units implement their own individualized pollution prevention plans, or (3) neither. Responses were coded as nominal variables, 3 if mandate, 2 if encourage, and 1 otherwise. A second measure was used to determine whether firms believed that their prior pollution prevention investments influenced their corporate decisions. Responses were elicited using a three-point ordinal scale (high influence, moderate influence, and low influence).

Firms' technology and innovation capabilities were measured by two variables. Firms reported using the three-point scale (high influence, moderate influence, and low influence) whether they believed that (1) prior investments in innovative technologies and (2) prior investments in capital influenced their ISO 14001 corporate decisions. Finally, firms' corporate cultures were measured using the same scale to determine whether ISO 14001 adoption was consistent with their organizations' environmental principles.

Responses were grouped by the external and internal drivers described above for firms that mandated and encouraged ISO 14001. Because two types of responses were elicited—ordinal and nominal—the data were evaluated independently rather than by combining them in an index. In addition to evaluating the statistical results of the three-point ordinal responses, the data were also assessed by combining high and moderate responses and comparing them to low responses. This additional comparison was performed because external and internal pressures that have a moderate or high influence are more likely to prompt organizational action than are factors with low influences.

Data comparisons were performed using Fisher's exact test for contingency tables. This nonparametric approach was employed because the sample was necessarily small and as such typical parametric approaches would lead to poor approximations (Hess and Orphanides, 1995; Stokes, Davis and Koch, 1995). Fisher's exact test was used to determine the strength of the association between mandaters and encouragers and each external and internal driver. This procedure estimates highly conservative p-values, which is why in addition to conventional statistical levels ($p<0.05$) more liberal levels of significance ($p<0.10$) are also reported (Grusky, 1959; Rice, 1988; Kahn and Goldenberg, 1991; Hirota et al., 1999; Beirle and Konisky, 2000). Two-tailed statistical tests were performed on all comparisons. Finally, to compare the mean

number of employees between the two groups, a Wilcoxon test was performed for small sample continuous data.

Results

The descriptive statistics show that the firms are quite diverse in the industries that they operate in, as illustrated in Table 3. The industries with the most ISO 14001-certified firms were the chemical, transportation equipment, and electronic and electrical equipment industries. The table also shows that the number of firms that had mandated ISO 14001 (in their facilities, divisions, and subsidiaries) was not exclusive to any particular type of industry.

Table 3: Mandates by Industry Types

SIC Codes	No. Firms	Actual SIC	Industry Type	Firms by SIC	Mandate Type			
					Facility	Division	Subsid.	ALL
10-19	1	16	Heavy Construction	1	1	1	.	.
20-29	14	20	Food and Kindred Products	2	1	1	.	.
		25	Public Building Construction	2	1	1	.	.
		26	Paper and Allied Products	3	2	.	2	2
		28	Chemicals And Allied Products	6	1	1	1	1
		29	Petroleum Refining	1	1	.	.	.
30-39	32	30	Rubber & Misc. Plastics Products	1	.	.	.	.
		32	Stone, Clay, Glass, & Concrete Prod.	1	1	1	.	.
		33	Primary Metal Industries	2	1	1	.	.
		34	Fabricated Metal Products	5	4	3	2	2
		35	Industrial Machinery & Equip.	5	2	1	1	1
		36	Electronic & Electric Equip.	7	2	3	.	.
		37	Transportation Equipment	10	6	5	1	1
		39	Misc. Manufacturing Industries	1	.	.	.	.
40-49	6	42	Electric, Gas, & Sanitary Services	5	1	1	.	.
		49	Power Distribution	1	.	.	.	.
TOTAL	*53*			*53*	*24 (45%)*	*19 (35%)*	*7 (13%)*	*7 (13%)*

Just under half of the sample firms (45%) had mandated that their facilities certify to ISO 14001, whereas 35 percent had mandated that their divisions register to ISO 14001. All of the firms that had required that their subsidiaries certify (13%) had also mandated that all their facilities and divisions register their EMSs to ISO 14001, and every firm that had a divisional mandate also had a facility mandate.[7]

The mean number of employees was approximately 59,400 employees. A difference of means test showed that there is no statistical difference between the mean number of employees for mandaters and encouragers. There was also no statistical difference between S&P 1500 firms and non-S&P 1500 firms and whether they mandated ISO 14001 or not, that is, they both mandated ISO 14001 at statistically similar rates.

External drivers. Table 4 describes the influences for three types of mandates—facility, division, and subsidiary mandates for ISO 14001 certification. For each type of pressure, two

[7] Approximately three-quarters of the firms that had facility mandates also had either a division or subsidiary mandate as well.

sets of values are detailed. The first set represents the degree of importance (high importance, moderate importance, and low importance) that each pressure had on mandaters' corporate directives. The second set of values, which is below the first, represents the degree of importance that each pressure had on corporate decisions to encourage ISO 14001.

Table 4: Comparison of External Drivers for Firms that Mandate ISO 14001 & Firms that "Encourage" it

External Driver	Mandate/No Mandate								
	Facility (n=24/29)			*Division (n=34/19)*			*Subsid. (n=7/45)*		
	H	M	L	H	M	L	H	M	L
Regulatory Pressures									
1. Improve Compliance*	58%	38%	4%	63%	37%	0%	43%	57%	0%
	38%	38%	24%	38%	38%	24%	48%	35%	17%
2. Potential for Reg. Benefits*	50%	38%	12%	53%	42%	5%	57%	29%	14%
	31%	38%	31%	32%	35%	32%	37%	29%	34%
3. Availability of Govt. Assist. Programs*	4%	38%	58%	5%	42%	57%	14%	29%	57%
	0%	17%	83%	0%	18%	82%	0%	26%	74%
Market Pressures									
1. Customers Mandate 14001*,**	58%	–	42%	53%	–	47%	71%	–	29%
	31%	–	69%	38%	–	62%	39%	–	61%
2. U.S. Customer Pressure	29%	29%	42%	21%	42%	37%	29%	43%	29%
	41%	24%	35%	44%	18%	37%	37%	24%	39%
3. Int'l Customer Pressures*	50%	21%	29%	42%	32%	36%	43%	29%	29%
	55%	10%	35%	59%	6%	35%	54%	13%	33%
4. U.S. Supplier Pressures	4%	21%	75%	5%	26%	68%	14%	29%	57%
	4%	31%	65%	3%	26%	71%	2%	26%	72%
5. Int'l Supplier Pressures	9%	26%	65%	11%	33%	56%	14%	43%	43%
	3%	28%	69%	2%	24%	74%	4%	24%	71%
6. Shareholders	13%	46%	42%	16%	47%	37%	14%	29%	57%
	14%	21%	65%	12%	24%	65%	13%	33%	54%
7. Insurers may Reward	8%	33%	38%	5%	47%	47%	14%	57%	29%
	7%	41%	52%	8%	32%	59%	7%	35%	59%
8. May be Valuable Marketing Tool*	44%	44%	14%	50%	44%	6%	50%	33%	17%
	28%	48%	44%	26%	47%	47%	33%	48%	20%
9. May Reduce Costs	58%	29%	13%	58%	32%	11%	71%	29%	0%
	41%	35%	24%	44%	32%	24%	46%	33%	23%
10. May Increase Revenues	29%	50%	21%	32%	53%	16%	57%	29%	14%
	38%	28%	34%	35%	29%	35%	30%	39%	30%
11. May Provide Competitive Advantage*	70%	26%	4%	79%	22%	0%	86%	14%	0%
	41%	41%	10%	44%	44%	12%	51%	40%	9%
12. Env. Professionals Support 14001*	44%	35%	22%	47%	37%	16%	57%	29%	14%
	7%	38%	55%	9%	36%	56%	18%	38%	44%
Social Pressure									
1. External Stakeholder Pressure	13%	38%	50%	11%	47%	42%	14%	28%	57%
	10%	52%	38%	12%	42%	42%	11%	48%	41%
2. May be a Valuable Public Relations Tool	39%	48%	14%	44%	50%	6%	50%	33%	17%
	34%	38%	48%	32%	38%	41%	35%	44%	22%

* Statistically significant comparison. See Table 5 for specific differences and *p* values.
**Represents a dichotomous variable.

The results show that mandaters experienced higher overall external pressures prior to making their corporate directive. That is, 14 of the 17 external pressures had greater degrees of high and moderate influence on mandaters' corporate decisions than was true for encouragers. Similar results are seen across all three types of corporate mandates—facility, division, and subsidiary. Eight of these 14 external pressures, moreover, are statistically significant for the three levels of mandate decisions, as illustrated in Table 5.

Table 5: Statistical Differences of External Drivers

External Drivers	Statistical Differences between Mandate/No Mandate Category (p value <):		
	Facility	**Division**	**Subsidiary**
Regulatory Pressures			
May Improve Firm's Compliance	0.10	0.04	—
May Lead to Regulatory Benefits	—	0.06	—
Government Assistance made ISO 14001 Mandates Attractive	0.08	0.03	0.09
Market Pressures			
International Customers Pressure for ISO 14001	—	0.06	—
Customers Mandate ISO 14001	0.06	—	—
May Provide Competitive Advantage	—	0.06	—
May be a Valuable Marketing Tool	—	0.09	—
Environmental Professionals Increasingly Endorse ISO 14001	0.01	0.01	0.08

Of all the external drivers, regulatory pressures (and in particular regulatory compliance pressures) had one of the greatest influences on all firms' ISO 14001 decisions and only the desire to increase competitive advantage was more influential. Despite the high overall influences of regulatory pressures, mandaters were influenced more than were encouragers. Between 88 percent and 100 percent of mandating firms reported that the possibility of improving their compliance had either a high or moderate influence on their decisions to require facilities (p<0.10) and divisions (p<0.04) to certify to ISO 14001. In contrast, 76 percent of encouragers reported that the possibility of improving their compliance had either a high or moderate influence on their facility-level and division-level decisions. While there was no statistical difference for subsidiaries, perhaps because of the reduced control that parent companies have over them, lower sample sizes for firms that mandated their subsidiaries to adopt ISO 14001 also made statistical significance more difficult to achieve.

Traditional regulatory pressures were not the only regulatory factors that influenced firms differently. Between 95 and 100 percent of mandating firms reported that the potential to receive regulatory benefits had either a high or moderate influence on their mandate decisions at the divisional level (p<0.06), whereas only 67 percent of encouragers were influenced by regulatory benefits. While no regulatory benefits had been realized by 1999, when most of the firms in this study had already made their ISO 14001 decisions, EPA is presently considering these benefits in the form of expedited and consolidated permitting, and waivers of some state and federal regulations if they achieve environmental results that are superior to those otherwise required by law.

Government assistance programs were not nearly as influential as were the other regulatory drivers, as most firms reported that these programs were only a moderate factor in their decisions. Despite its less prominent role, technical assistance programs motivated

mandaters' decisions more (p<0.03 - 0.09). Between 42 and 47 percent of mandaters reported that technical assistance had a high or moderate influence, as compared to 17 to 26 percent of encouragers. These results, combined with the high influence of potential regulatory benefits offer important information to public policy makers who seek information regarding the effectiveness that government incentives have in persuading companies to certify to ISO 14001, as the traditional regulatory system coupled with regulatory benefits were more effective motivators for these firms.

Unlike regulatory pressures, of which all had affected firms' decisions to mandate ISO 14001 in one form or another, less than half of the market drivers statistically explained the differences between firms' decisions to mandate or encourage ISO 14001 adoption. In fact, firms responded similarly to pressures from U.S. customers, U.S. and foreign suppliers, shareholders, insurers, and internal factors to reduce costs and increase revenues.

Of all the external pressures, the belief that ISO 14001 may provide a competitive advantage was the greatest motivator for *both* mandaters and encourages, although mandaters reported that this factor had a greater influence on their division-level decisions (p<0.06). At the division-level, all of the mandaters reported that they adopted ISO 14001 because it may provide them with a competitive advantage, whereas 88 percent of encouragers believed this to be true. Other market pressures also influenced mandaters to a greater degree. The belief that at the division-level ISO 14001 could be leveraged as a valuable marketing tool (p<0.09) was higher for mandaters than was true for encouragers. These two findings are supplemented with additional evidence of the influence of market pressures in that mandaters' facility-level corporate directives were influenced more by customers who required the use of ISO 14001 (p<0.06). As well, at the division-level mandaters endured greater international customer pressures (p<0.06). Finally, normative pressures from environmental professionals had a greater influence on all mandaters' decisions (p<0.01 - 0.08). Together, these findings suggest that mandaters endure greater market pressures than do encouragers. They also point to the importance the market has in persuading ISO 14001 among different types of firms. Indeed, the compelling belief that ISO 14001 may help firms to maintain or gain advantage against their competitors may be reason alone for firms to consider ISO 14001 certification in their operational units.

In contrast, social drivers had only moderate influence on both types of corporate-level ISO 14001 policies. While the possibility of increasing public relations opportunities did moderately influence all firms' ISO 14001 certification decisions similarly, the perceived pressure being exerted by external stakeholders was quite low, and did not explain statistically why firms might choose to impose an ISO 14001 mandate or not.

Internal Capabilities. Overall, the internal capabilities of mandaters were greater than encouragers, and 6 of the 8 measures were statistically significant (see Table 6). These results support the notion that firms that mandate ISO 14001 have stronger internal capabilities than do encouragers. Differences between subsidiary-level decisions, however, are less prevalent, perhaps because of the reduced managerial control that parent companies have over subsidiaries. Lower sample sizes for firms that mandated their subsidiaries to adopt ISO 14001, moreover, made statistical significance more difficult to achieve.

Table 6: Comparison of Internal Capabilities for Firms that Mandate ISO 14001 and those that "Encourage" it

Internal Capability	Mandate/No Mandate								
	Facility (n=24/29)			*Division (n=34/19)*			*Subsid. (n=7/45)*		
	H	M	L	H	M	L	H	M	L
Mgt. System Capability									
1. Prior ISO 9001 (Mandate,	67%	29%	4%	74%	21%	5%	43%	43%	14%
Encouragement, or Neither)*, **	32%	64%	4%	33%	63%	3%	49%	49%	2%
Environmental Mgt. Capability									
1. Prior P2 Plan (Mandate,	67%	13%	14%	74%	11%	16%	71%	14%	14%
Encourage, or Neither)**	57%	29%	21%	56%	27%	18%	60%	22%	18%
2. Prior Pollution Prevention	46%	38%	16%	47%	37%	16%	43%	57%	0%
Investments*	14%	45%	42%	18%	44%	38%	26%	39%	35%
3. May improve Employees'	54%	46%	0%	58%	42%	0%	57%	43%	0%
Participation in Env. Affairs*	38%	45%	17%	38%	47%	15%	44%	45%	11%
Innovation & Capital Capabilities									
1. Prior Innovative Technology	17%	42%	42%	16%	53%	32%	0%	72%	29%
Investments*	7%	28%	56%	9%	24%	68%	13%	28%	59%
2. Prior Capital Investments*	8%	58%	33%	11%	63%	26%	0%	86%	14%
	0%	31%	59%	0%	32%	68%	4%	37%	59%
Organizational Culture									
1. ISO 14001 is Consistent with	88%	12%	0%	84%	16%	0%	86%	14%	0%
Firm's Environ. Principles*	59%	27%	14%	65%	24%	12%	69%	23%	9%

* Statistically significant comparison. See Table 7 for specific differences and *p* values.

** Represents a nominal variable where H=parent requires, M=parent encourages, L=neither.

In evaluating firms' continuous improvement capabilities, while almost all of the firms either required or encouraged ISO 9001 (between 88 and 99 percent) prior to making their ISO 14001 policy decisions, mandaters required ISO 9001 in their facilities and divisions more (p<0.03, 0.01), as shown in Table 7. For this reason, mandaters are more likely to have developed a continuous improvement capability in all their operations that would provide a basic-level capacity to support their ISO 14001 mandate. Because of this preexisting capability, EMS implementation likely demanded fewer internal resources and was more easily integrated into the facility's management practices themselves (Sarkis and Kitazawa, 2000) making environmental goals a component of their quality-focused production (Darnall, Gallagher and Andrews, 2000; Darnall, 2002).

With respect to firms' prior environmental management capabilities, most of them (between 79 and 86 percent) had either required or encouraged that their operations have a pollution prevention plan. Despite these similarities, mandaters reported that their pollution prevention investments were more influential to their ISO 14001 directives at the facility- and division-level than was true for encouragers (p<0.03 - 0.05). Whether these differences might be explained by the degree of mandaters' environmental investments being greater or whether their investments resulted in more improved environmental outcomes is uncertain, as this information was not available. Mandaters also hoped that by requiring ISO 14001 they would further improve upon their firms' environmental management capabilities. That is mandaters' facility and division-level decisions were motivated more (p<0.10, 0.07) by the possibility that ISO 14001 would improve their employees' participation in their environmental affairs.

Table 7: Statistical Differences of Internal Capabilities

Internal Capabilities	Statistical Differences between Mandate/No Mandate Category (p value <):		
	Facility	Division	Subsidiary
Continual Improvement Capability			
ISO 9001 Mandate, Encouragement, or Neither	0.03	0.01	—
Environment Mgt. Capability			
Prior Pollution Prevention Investments Made 14001 Attractive	0.03	0.05	—
May Improve Employees' Participation in Firms' Env. Affairs	0.10	0.07	—
Innovation & Technology Capability			
Prior Innovative Technology Investments Made Certif. Attractive	—	0.04	—
Prior Capital Investments Made Certification Attractive	0.01	0.01	0.06
Culture			
ISO 14001 is Consistent with the Firm's Overall Env. Principles	0.05	—	—

While prior innovation and technology capabilities did not have as much influence on firms' decisions as compared to other internal capabilities, mandaters were motivated more by them. Sixty-eight percent of mandaters report that their investments in innovative technologies influenced their ISO 14001 policies. In contrast, 32 percent of encouragers reported that these factors motivated their ISO 14001 decisions (p<0.04). Similarly, mandaters differed from encouragers in the influence their prior capital investments had on their decisions to require their facilities, divisions, and subsidiaries to adopt 14001. While this variable overall had only a moderate influence on firms' decisions, it was greater for mandaters at all operational levels (p<0.01, 0.01, 0.06).

Finally, mandaters reported that their organizational cultures also affected their corporate-level facility mandates to a greater degree than was true for firms that merely encouraged ISO 14001 (p<0.05). Indeed, corporate culture was the most powerful driver included in the study. None of the mandaters reported that it had a low influence and 88 percent reported it as a high motivator in their corporate directive. In contrast, only 59 percent of the encouragers report it as high influence.

Collectively, the internal driver results offer insight into firms' decisions to mandate ISO 14001. Mandaters not only had greater internal capabilities prior to making their corporate mandates, but also considered these capabilities as more central to their corporate decisions regarding ISO 14001. Combined with the influence that external drivers had on firms' decisions to mandate ISO 14001, these findings support the general hypothesis, that firms which mandate ISO 14001 in their operational units have stronger external pressures and greater internal capabilities prior to making their corporate decision regarding ISO 14001 than firms that merely encourage ISO 14001.

Discussion and Implications

The results of this study demonstrate that while ISO 14001 is implemented at the facility level, the parent company often plays a strong role in implementation decisions. The strongest type of corporate involvement—a mandate—was prevalent in more than half of the firms included in this study, and comprise at least one-quarter of all corporations that have facilities

adopting ISO 14001 in the U.S. These findings have important implications for EPA officials who are designing programs that encourage *facilities* to adopt ISO 14001, as it is often the parent company that decides whether its operational units should certify their EMSs to 14001 or not.

The firms that mandated ISO 14001 did so primarily for four reasons: (1) to achieve a greater competitive advantage, (2) because it was consistent with their corporate culture, (3) because it builds on well-developed internal proficiencies, and (4) because it may help them to maintain their regulatory compliance. These findings raise the question that if not for government incentives, would publicly traded firms mandate or encourage ISO 14001. While the results presented here cannot provide definitive evidence, they do show that such incentives are less relevant to publicly traded firms. Incentives such as government assistance was not critical to firms' decisions to either mandate or encourage ISO 14001. This is likely due to the fact that firms which are adopting ISO 14001 do not need the assistance because their internal capacities were already relatively well developed. This notion is verified by previous work which found that *facilities* which were owned by publicly traded firms that had stronger internal capabilities were also less influenced by EPA technical assistance programs (Darnall, 2002). The potential for regulatory benefits such as consolidated or expedited permitting and regulatory waivers did, however, play a role, although not to the same degree that the four primary factors did.[8] Thus, while government may encourage EMS by offering incentives, unless actual regulatory benefits (rather than potential ones) are extended, such incentives will likely have less effect on publicly traded firms.

In considering EPA's encouragement of EMSs in U.S. businesses, this research also shows that ISO 14001 may require at least basic levels of systems-based management knowledge and prior environmental management capabilities that can support EMS implementation. These capacities are not only important for generating momentum for EMS implementation, but will reduce the marginal implementation costs than is true for firms who lack similar capabilities (Florida, 1996). While public policy may attempt to motivate more widespread EMS adoption through regulatory benefits, extant literature suggests that firms will be less able to support higher-level environmental management strategies over time and achieve their desired environmental and organizational goals if prior capabilities are not present (Christmann, 2000). Because EMSs require often require substantive resources to implement and maintain, an organization that fails in its effort to manage them over time or achieve their desired environmental goals may lose managerial support for future resource-intensive environmental investments. Such an outcome may in fact be counterproductive to EPA's environmental protection goals.

In relating these findings to prior theoretical research, despite the fact that all the firms in this study were similar along multiple dimensions, firms that established ISO 14001 mandates endured greater overall external pressures and had significantly stronger internal capabilities prior to making their decisions to mandate ISO 14001. Indeed, there was no single situation in which firms that merely encouraged ISO 14001 had statistically greater external pressures exerted on them or stronger internal capabilities prior to making their corporate decisions. Such results confirm prior research on institutional theory and RBV and take an initial step at

[8] For smaller privately owned firms and government operations, however, which have fewer internal capabilities, government incentives may be critical to encouraging more widespread EMS adoption (Darnall, 2001).

evaluating the two theories together. This integrated approach is important because there are likely interactions between firms' external pressures and their internal capabilities. For example, mandaters had more operational units certified to ISO 9000, and over four-fifths of all firms had pollution prevention plans prior to making their ISO 14001 corporate policies. These capabilities, like the decision to mandate or encourage ISO 14001, were likely influenced by various external pressures. As such, a greater understanding of the interactions between these two factors appears to be key in examining the rationales for why organizations change their environmental strategies, and while several researchers have recognized the importance for integration of institutional and RBV theories (Rugman and Verbeke, 1998; Henderson and Mitchell, 1997; Christmann, 2000; Oliver, 1997), the field is ripe for additional explanation and empirical examination.

Finally, future research should consider how firms' motivations to mandate or encourage ISO 14001 differ from firms that have no operational units that are certified to the standard. The framework presented here suggests is that non-adopters will have even *weaker* external pressures and *fewer* internal capabilities that may support a mandate or an informal encouragement. These potential differences also have logical extensions towards hypothesis testing for environmental performance changes over time as firms that achieve greater levels of environmental performance may do so because they endure greater institutional pressures and possess the higher-order learning proficiencies that are developed over time.

REFERENCES

Aldrich, Howard E. (1999), Organizations Evolving, Sage Publications: London.

Andersson, L.M. and T.S. Bateman (2000), 'Individual environmental initiative: championing natural environmental issues in U.S. business organizations, Academy of Management Journal, 43(4), 548-570.

Arora, S. and S. Gangopadhyay (1995), 'Toward a theoretical model of voluntary overcompliance,' Journal of Economic Behavior and Organization, 28(3), 289-309.

Arora, S. and T. Cason (1996), 'Why do firms volunteer to exceed environmental regulations? Understanding participation in EPA's 33/50 program,' Land Economics, 72(4), 413-32.

Barney, J. (1986), 'Strategic factor markets: expectations, luck, and business strategy,' Management Science, 32(10), 1231-1241.

Barney, J. (1991), 'Firm resources and sustained competitive advantage,' Journal of Management, 17(1), 99-120.

Beirle, T.C. and D.M. Konisky (2000), Values, Conflict, and Trust in Participatory Environmental Planning, Journal of Public Policy Analysis and Management, 19(4), 587-602.

Bowen, F. E. (2000), 'Does size matter? A meta-analysis of the relationship between organisation size and environmental responsiveness,' paper presented at the International Association for Business and Society Annual Meeting, Vermont, March 2000.

Bowen, F.E., P.D. Cousins, R.C. Lamming and A.C. Faruk (2001), 'Explaining the implementation of green supply initiatives: the role of supply management capabilities,' Production and Operations Management, forthcoming.

Christmann, P. (2000), 'Effects of 'best practices' of environmental management on cost competitiveness: the role of complementary assets,' Academy of Management Journal, 43(4), 663-880.

Collis, D.J. and C.A. Montgomery (1995), 'Competing on resources: strategy in the 1990's,' Harvard Business Review, 73(4), 118-128.

Cordano, M. and I.H. Frieze (2000), 'Pollution reduction preferences of U.S. environmental managers: applying Ajzen's theory of planned behavior,' The Academy of Management Journal, 43(4), 627-641.

Darnall, Nicole (2002), 'Motivations for participating in a voluntary environmental initiative: the Multi-state Working Group and EPA's EMS pilot program,' In Sanjay Sharma and Mark Starik (eds.) Research in Corporate Sustainability, Boston: Edward Elgar Publishing, (Forthcoming).

Darnall, N., D.R. Gallagher and R.N.L. Andrews (2001), 'ISO 14001: greening management systems,' Joseph Sarkis (ed.), Greening Manufacturing and Operations: From Design to Delivery and Back, Sheffield, UK: Greenleaf Publishing, forthcoming.

Darnall, N., D.R. Gallagher, R.N.L. Andrews and D. Amaral (2000), 'Environmental management systems: opportunities for improved environmental and business strategy,' Environmental Quality Management, 9(3), 1-9.

Davies, Terry, Janice Mazurek, Nicole Darnall, Kieren McCarthy (1996), Industry Incentives for Environmental Improvement: Evaluation of U.S. Federal Initiatives, Washington DC: Resources for the Future, Center for Risk Management.

Deming, W. Edwards (1986), Out of the Crisis. Cambridge, MA: MIT Press.

Denison, Daniel R. (1990), Corporate Culture and Organizational Effectiveness, New York: John Wiley & Sons.

DiMaggio, P. and W. Powell (1983), The iron cage revisited: institutional isomorphism and collective rationality in organizational fields, American Sociological Review, 48(2), 147-160.
Egri, C.R. and S. Herman (2000), Leadership in the North American environmental sector: values, leadership styles, and contexts of environmental leaders and their organizations, The Academy of Management Journal, 43(4), 561-604.
Florida, R. (1996), 'Lean and green: the move to environmentally conscious manufacturing,' California Management Review, 39(1), 80-105.
Garrod, B. and P. Chadwick (1996), 'Environmental management and business strategy: towards a new strategic paradigm,' Futures, 28(1), 37-50.
Grant, R.M. (1991), 'The resource-based theory of competitive advantage,' California Management Review, 33(3), 114-135.
Grusky, O. (1959), 'Organizational goals and the behavior of informal leaders,' American Journal of Sociology, 65(1), 59-67.
Hart, S. (1995), 'A natural-resource-based view of the firm,' Academy of Management Review, 20(4), 986-1014.
Hart, S. and G. Ahuja (1996), 'Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance,' Business Strategy and the Environment, 5(1), 30-37.
Henderson, R. and W. Mitchell (1997), 'The interactions of organizational and competitive influences on strategy and performance,' Strategic Management Journal, 18(7), 5-14.
Henriques, I. and P. Sadorksy (1999), 'The Relationship Between Environmental Commitment and Managerial Perceptions of Stakeholder Importance,' The Academy of Management Journal, 42(1), 89-99.
Henriques, I. and P. Sadorsky (1996), The determinants of an environmentally response firm: an empirical approach. Journal of Environmental Economics and Management, 30(3), 381-395.
Hess, G. and A. Orphanides (1995), 'War politics: an economic, rational-voter framework,' The American Economic Review, 85(4), 828-846.
Hirota, S., T. Saijo, Y. Hamaguchi and T. Kawagoe (1999), 'Does the Free-Rider Problem Occur in Corporate Takeovers? Evidence from Laboratory Markets,' Paper presented at New Developments in Experimental Economics Conference, Osaka, Japan.
Hoffman, Andrew (2000), Competitive Environmental Strategy: A Guide to the Changing Business Landscape, Washington, D.C.: Island Press.
Jaffe, A., S. Peterson, P. Portney and R. Stavins (1995), 'Environmental regulation and the competitiveness of US manufacturing: what does the evidence tell us? Journal of Economic Literature, 33(1), 132-163.
Jennings, P.D. and P.A Zandbergen (1995), 'Ecologically sustainable organizations: an institutional approach,' Academy of Management Review, 20(4), 1015-1052.
Kahn, K. and E. Goldenberg (1991), 'Women candidates in the news: an examination of gender differences in US Senate campaign coverage,' Public Opinion Quarterly, 55(2), 180-199.
Khanna, M. and L.A. Damon (1999), 'EPA's voluntary 33/50 program: impact on toxic releases and economic performance of firms,' Journal of Environmental Economics and Management, 37(1), 1-25.
King, A. and M. Lenox (2000), 'Industry self-regulation without sanctions: the chemical industry's responsible care program,' Academy of Management Journal, 43(4), 698-716.
Klassen, R.D. (2000), 'Exploring the linkage between investment in manufacturing and environmental technologies,' International Journal of Operations and Production Management, 20(2), 127-147.

Klassen, R.D. and C.P. McLaughlin (1996), 'The impact of environmental management on firm performance,' Management Science, 42(8), 1199-1214.

Konar, S. and M. Cohen (1997), 'Information as regulation: the effect of community right to know laws on toxic emissions,' Journal of Environmental Economics and Management, 32(1), 109-124.

Lawrence, A.T. and D. Morell (1995), 'Leading edge environmental management: motivation, opportunity, resources and processes,' Research in Corporate Social Performance and Policy, Supplement 1, 99-126.

Lutz, S., P.L. Thomas and J.W. Maxwell (2000), 'Quality leadership when regulatory standards are forthcoming,' Journal of Industrial Economics, 48(3), 331-348.

Makower, Joel, (1993) The E Factor: The Bottom-Line Approach to Environmentally Responsible Business, New York: Random House.

Marshall, M.E. and D.W. Mayer (1991), 'Environmental training: it's good business,' Business Horizons, March/April, 54-57.

McGuire, J.B., A. Sundren and T. Schneeweis (1988), Corporate social responsibility and firm financial performance, Academy of Management Journal: 31(4), 854-872.

McGuire, J.B., T. Schneeweis and B. Branch (1990), Perceptions of firm quality: a cause or result of firm performance, Journal of Management, 16(1), 167-180.

Muoghalu, M., H.D. Robinson and J.L. Glascock (1990), Hazardous waste lawsuits, stockholder returns, and deterrence, Southern Economic Journal, 57(2), 357-370.

Oliver, C. (1997), 'Sustainable competitive advantage: combining institutional and resource-based views,' Strategic Management Journal, 18(9), 679-713.

Penrose Edith (1959), The Theory of the Growth of the Firm, 3rd ed., Basil Blackwell: Oxford, U.K.

Perrow, Charles (1986) Complex Organizations: A Critical Essay, 3rd ed. New York: Random House.

Porter, M. and C. van der Linde (1995), 'Green and competitive: ending the stalemate,' Harvard Business Review, September/October, 120-137.

Rajan, S.R. (2001), 'What Disasters tell us about environmental violence: the case of the Bhopal gas disaster,' Michael Watts and Nancy Peluso (eds.) Violent Environments, Ithaca: Cornell University Press, forthcoming.

Rice, W. R. (1988), 'A new probability model for determining exact p-values for 2X2 contingency tables when comparing binomial proportions,' Biometrics, 44(1), 1-22.

Roome, N. (1992). Linking quality and the environment, Business Strategy and the Environment, 1(1), 11-24.

Rugman, A. and A. Verbeke (1998), 'Corporate strategies and environmental regulations: an organizing framework,' Strategic Management Journal, 19(4), 363-375.

Rumelt, R.P. (1984), 'Towards a strategic theory of the firm.' In R. Lamb (ed.), Competitive Strategic Management, Englewood Cliffs, NJ: Prentice-Hall.

Russo, M. and P. Fouts (1997), 'A resource-based perspective on corporate environmental performance and profitability,' Academy of Management Journal, 40(3), 534-559.

Salop, S.C. and D.T. Scheffman, (1983). Raising rivals' costs, American Economic Association Papers and Proceedings, 73(2), 267-271.

Sarkis, J. and S. Kitazawa (2000), 'The relationship between ISO 14001 and continuous source reduction programs.' International Journal of Operations and Production Management, 20(2), 225-248.

Schein, Edgar H. (1992) Organizational Culture and Leadership, 2nd ed, San Francisco: Jossey-Bass Publishers.

Sharma, S. (2000), 'Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy,' The Academy of Management Journal, 43(4), 681-697.
Sharma, S. and H. Vredenburg (1998), 'Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities.' Strategic Management Journal, 19(8), 729-753.
Sharma, S. and O. Nguan (1999), 'The biotechnology industry and strategies of biodiversity conservation: the influence of managerial interpretations and risk propensity.' Business Strategy and the Environment, 8(1), 46-61.
Shewhart, Walter A. (1931). Economic Control of Quality of Manufactured Product, New York, NY: Van Nostrand.
Shrivastava, P. (1995), The role of corporations in achieving ecological sustainability, Academy of Management Review, 20(4): 936-960.
Shrivastava, P. (1995), Ecocentric management for a risk society, Academy of Management Review, 20(1), 118-137.
Stokes, Maura E., Charles S. Davis and Gary G. Koch (1995), Categorical Data Analysis: Using the SAS System, Cary, NC: The SAS Institute.
Waddock, S. and Graves, S. (1997) The corporate social performance—financial performance link, Strategic Management Journal, 18(4), 303-319.
Walley, N. and Whitehead, B. (1994), It's not easy being green, Harvard Business Review, 72(3), 2-7.
Welch, E., A. Mazur and S. Bretschneider (2000), 'Voluntary behavior by electric utilities: levels of adoption and contribution of the climate change program to the reduction of carbon dioxide,' Journal of Public Policy Analysis and Management, 19(3), 407-425.
Welford, R. (1992), 'Linking quality and the environment: a strategy for the implementation of environmental management systems,' Business Strategy and the Environment, 1(1), 25-34.
Wernerfelt, B. (1984), 'A resource-based view of the firm,' Strategic Management Journal, 5(2), 171-180.
Willig, John T. (ed.) (1994), Environmental TQM, 2nd ed. New York: McGraw-Hill.