

# Why Firms Mandate ISO 14001 Certification

Nicole Darnall  
*George Mason University*

Thousands of facilities worldwide have certified to International Organization for Standardization (ISO) 14001, the international environmental management system standard, and previous research typically has studied these certification decisions at the facility level. However, significant anecdotal evidence indicates that firms may have a strong role, and if so, prior studies may be drawing inappropriate conclusions about the rationale for ISO 14001 certification. Drawing on institutional theory and the resource-based view of the firm, this study offers a conceptual framework that explains why parent companies would mandate—rather than simply encourage—their operational units to certify to ISO 14001. The framework is tested using survey data of corporate environmental managers. The results show that firms have a central role in nearly half of all facility-level certifications and that firms that mandate ISO 14001 endure greater external pressures and have stronger complementary resources and capabilities that support their organization-wide ISO 14001 policies.

**Keywords:** *corporate mandate; ISO 14001; environmental management system; institutional theory; resource-based view; complementary capabilities*

In recent years, researchers of business strategy and public policy have become increasingly interested in why *facilities* certify their environmental management systems (EMS) to International Organization for Standardization (ISO) 14001, the international EMS standard (e.g., King & Lenox, 2001; King, Lenox, & Terlaak, 2005; Potoski & Prakash, 2005). Decisions to certify are interesting for several reasons. First, regulators do not require ISO 14001, and prior to the year 2001, U.S. buyers were not requiring certification as a condition of doing business.<sup>1</sup> As such, early

---

**Author's Note:** I am grateful to Richard N. L. Andrews, Stuart Hart, Carolyn Heinrich, Randall Kramer, Mark Milstein, and Michael Munger for their comments on earlier drafts. Thanks also are due to Daniel Edwards Jr., for his research assistance.

adopters of ISO 14001 were certifying their EMSs voluntarily and in the absence of coercive market pressures. Second, achieving ISO 14001 certification requires a significant commitment of resources (Darnall & Edwards, in press), and whereas the organization incurs the cost of certification, the potential environmental benefits associated with reducing pollution can be enjoyed by society at large. Third, organizations that certify to ISO 14001 may be able to enhance their environmental image and confer external legitimacy (Bansal & Hunter, 2003). They also may be able to use ISO 14001 to increase their internal efficiencies and create competitive advantage opportunities and economic benefits (Coglianese & Nash, 2001). Together, the voluntary nature (Manne & Wallich, 1972), commitment of resources (Hay, Gray, & Gates, 1976), and potential societal and economic benefits (Backman, 1975) of certification create at least the appearance that ISO 14001–certified facilities are trying to be socially responsible.

However, one aspect ignored in prior research is the notion that *firms* may have a central role in the facility-level decision to adopt ISO 14001 in that they may require or encourage certification in their operational units. If so, then greater social responsibility may exist firmwide rather than at the facility alone. Moreover, conclusions drawn about facility-level motivations of ISO 14001 adoption that exclude influences of the parent company may overlook the most central reason why facilities adopt ISO 14001 and place importance on issues that otherwise are erroneous. Although some research has evaluated aspects of these firm-level decisions (e.g., Bansal & Hunter, 2003), these studies have compared firms that certified to ISO 14001 with firms that elected not to certify. As yet, we know little about firms' corporate mandates for ISO 14001 and why some companies require their operational units to adopt ISO 14001 whereas others merely encourage certification.

Understanding these relationships is important for three reasons. First, strategic decisions that relate to the environment often are estimated at the facility level (e.g., Andrews et al., 2003; Anton, Deltas, & Khanna, 2004; Darnall, 2003; Khanna & Anton, 2002; King et al., 2005; King & Lenox, 2001; Potoski & Prakash, 2005). However, by evaluating the influence of the firm, we may discover that facility managers have little influence on some types of strategic decisions (Oliver, 1991) related to the environment and that subsequent performance is affected by this strong corporate role. Second, there are competing theoretical reasons that may explain why firms insist that their operational units certify to ISO 14001. Prior research drawing on institutional theory has shown that a firm's motivation to undertake a voluntary environmental action is affected by pressures from regulators

and markets (Arora & Cason, 1995; Khanna & Damon, 1999). However, other studies have concluded that organizations with stronger complementary capabilities might undertake proactive environmental strategies (Christmann, 2000; Hart, 1995; Rugman & Verbeke, 1998; Russo & Fouts, 1997; Sharma & Vredenburg, 1998). Consequently, an appreciation of institutional theory, in addition to the company's internal competencies, may be important to explaining whether companies undertake certain management strategies (Oliver, 1997) that are centralized within the corporate hierarchy.

Finally, ISO 14001 has the potential to be utilized by a significant number of corporations, because it does not preclude any industries or companies from obtaining certification as long as the company fulfills the standard's goals and receives third-party certification. In addition, ISO 14001 is the only EMS standard established globally, and the most widely recognized voluntary environmental standard. For these reasons, ISO 14001 has the potential to affect more firms globally and affect more facility operations than any other environmental certification program. Understanding why firms see value in the international standard therefore provides essential insights about the global adoption of this important standard and its diffusion worldwide.

This research evaluates corporate environmental decisions to mandate ISO 14001 in their operational units. It describes the ISO 14001 standard, its strategic value, and how institutional pressures and resources and capabilities might influence companies to institute firmwide certification mandates. Corporate-level decisions are evaluated empirically, using survey data, by comparing decision criteria for companies that mandate ISO 14001 certification in their operational units to companies that merely encourage certification.

## **Understanding ISO 14001**

### **The ISO 14001 Context**

An EMS is a formal set of procedures that defines—generally in great detail—how an enterprise will manage its potential impacts to the natural environment. EMSs consist of a collection of internal policies, assessments, plans, and implementation actions (Coglianese & Nash, 2001) affecting the entire organizational unit and its relationships with the natural environment. Although the specific institutional features of EMSs vary across organizations, all EMSs involve establishing an environmental policy or plan; undergoing internal assessments of the company's environmental impacts

(including quantification of those impacts and how they have changed over time); establishing quantifiable goals to reduce environmental impacts, providing resources, and training workers; checking implementation progresses through systematic auditing to ensure that goals are being reached; correcting deviations from goal attainment; and undergoing management review (Coglianese & Nash, 2001).

Although many companies have employed EMSs for years, ISO 14001 is the first attempt to create an international EMS standard. Developed by the International Organization for Standardization in 1996, ISO 14001 adoption requires certification by an independent third-party auditor who helps ensure that the EMS conforms to the ISO 14001 standard. In preparation for certification, a firm must characterize the procedures and plans that form its EMS. Once certified, the ISO 14001 label indicates that the company has implemented a management system that documents the firm's pollution aspects and impacts and identifies a pollution prevention process (Bansal & Hunter, 2003) that is continually improved over time.

Although corporations may require that their organizational units certify to ISO 14001, certification to the standard occurs at the facility level. As a consequence, a corporation that requires that its divisions certify to ISO 14001 also must have each of its facilities certified. By April 2005, more than 88,800 facilities worldwide had certified their EMSs to ISO 14001, of which 4,671 facilities were U.S. based (Peglau, 2005).

Firms that mandate ISO 14001 organization-wide incur numerous costs. Such costs are due to the creation of a new EMS or the modification of an existing one in each facility, which entails staff time, documentation, materials and equipment, training, and environmental consultants (Kollman & Prakash, 2001). Combined, these costs average \$239 to \$1,372 per employee, depending on the organization's internal capabilities that are present prior to EMS adoption (Darnall & Edwards, in press). ISO 14001 certification also requires third-party certification audits, which can cost an additional \$29 to \$88 per employee (Darnall & Edwards, in press). A company that mandates all its facilities and divisions certify to ISO 14001 therefore commits to a significant financial commitment, especially for larger companies with several hundred operational units and tens of thousands of employees.

### **Strategic Benefits of ISO 14001**

ISO 14001 EMSs are based on Deming's (1986) continuous improvement cycle in that they encourage organizations to continually improve their environmental management practices. Continual improvement processes benefit

organizations by embedding environmental considerations deep within the firm so that they become an integral element of the business strategy (Shireman, 2003). The continual improvement of environmental practices also can facilitate pollution prevention by encouraging firms to substitute harmful inputs with more environmentally conscious ones and to eliminate some regulated processes altogether. Other efficiencies can accrue through the auditing process (Delmas, 2002) by reducing the risk of costly environmental accidents, lowering corporate liability exposure, and improving access and competitiveness in the marketplace (Adams, 1999).

Reducing environmental risk also may lead to improved relations with environmental regulators, especially for organizations that have had difficulties achieving compliance in the past. Companies that reduce their environmental impacts below legal reporting thresholds may no longer be subject to costly regulatory mandates (Coglianese & Nash, 2001). In addition, ISO 14001 certification can impart companies with opportunities to influence the policy-making processes because they qualify to participate in government-sponsored EMS programs that facilitate greater access to regulators (Darnall, 2003). Most environmental regulations are characterized by their command-and-control nature and often are perceived to be inflexible and economically inefficient. As such, better access to and influence over the regulatory process could benefit companies involved (Coglianese & Nash, 2001; Kollman & Prakash, 2001), and ISO 14001 certification may be a means to do so.

Other strategic benefits may accrue to ISO 14001–certified companies in that certification to the international standard requires that firms routinely scrutinize their internal operations, engage employees in environmental issues, continually monitor their progress, and increase their knowledge about their operations (Darnall & Edwards, 2006). Such actions can help firms improve their internal efficiencies and increase strategic value, because they depend on intensive employee involvement (Hart, 1995) and team production (Makower, 1993; Willig, 1994). These activities also help firms to increase employee morale and reassess environmental performance as a contribution to productivity and innovation (Pun & Hui, 2001). Because these actions rely on knowledge-based skills that are decentralized, they also are difficult for competitors to replicate (Hart, 1995).

In other instances, ISO 14001 may encourage companies to build on existing pollution prevention principles by developing more sophisticated environmental strategies. For instance, some firms may implement life cycle cost analysis to assess their activities at each step of their value chain—from raw materials access to disposition of used products (Allenby, 1991). These more advanced environmental strategies leverage basic pollution prevention

principles and extend them by integrating external stakeholders into product design and development processes (Hart, 2005). By using these techniques, firms can exit environmentally hazardous businesses, redesign existing product systems to reduce life cycle impacts, and develop new products with lower life cycle costs (Hart, 1995). EMSs also provide a framework that encourages firms to assess all of the aspects of their operations jointly. Doing so minimizes the shift of environmental harms from one subsystem to another (Shrivastava, 1995) and further increases organizational efficiency (Welford, 1992).

Finally, ISO 14001 has the potential to enhance participants' environmental image and confer external legitimacy (Bansal & Hunter, 2003). Although often difficult to quantify, enhanced image and legitimacy could lead to such things as increased sales, improved ability to recruit talented employees, and enhanced relations with external stakeholders (Kollman & Prakash, 2001). Combined, all these benefits suggest that competitive advantage opportunities exist for companies that certify to ISO 14001, which is why corporations may play a central role in some certification decisions by mandating that their facilities and strategic business units adopt the international standard. However, in other instances, firms are not anticipated to mandate ISO 14001 in their operational units, opting instead to let their facilities and strategic business units determine whether certification has value. Differences between these two types of companies might be explained in part by varying pressures exerted by organizations and individuals outside the firm and by differing complementary resources and capabilities that can make an ISO 14001 mandate attractive.

## **Theoretical Framework and Hypotheses**

### **Institutional Pressures**

In explaining corporate behavior, institutional theory suggests that external forces persuade organizations to undertake similar strategic actions (Hoffman, 1997; Scott, 2001). Within this research area, scholars challenge the notion that firms are exclusively profit seeking in that companies also recognize the importance of achieving social legitimacy for their long-term survival and competitiveness (Suchman, 1995). Legitimate businesses are those whose actions are seen or presumed to be desirable or appropriate within some socially constructed system of norms, values, beliefs, and definitions (Suchman, 1995). Legitimacy is determined beyond the firm's boundaries but within the broader community of which the firm is a part

(Hoffman, 1997). Within this research area, scholars have stressed the importance of regulative, normative, and cognitive pressures and how these pressures lead to organizational homogeneity (DiMaggio & Powell, 1983; Scott, 2001) and external legitimization (DiMaggio & Powell, 1983; Hoffman & Ventresca, 2002). Related to the decision to institute a corporate mandate for ISO 14001, previous research indicates that institutional pressures from regulators and markets may play a particularly strong role in encouraging companies to adopt similar environmental practices.

*Regulatory pressures.* Corporations are increasingly mindful of the environmental regulations that govern their operations, because their inability to adhere to these regulatory pressures may result in serious penalty, including legal sanction, costly court proceedings, and environmental penalties and fines. Of these pressures, fear of legal sanction is considered a primary reason why organizations adopt proactive environmental strategies (Hoffman, 1997). More specifically, regulatory pressures have been associated with an organization's environmental decisions to implement an environmental policy (Henriques & Sadorsky, 1996) and participate in a voluntary environmental program (Darnall, 2003). Penalties and fines also have been shown to encourage companies to disclose their environmental activities publicly (Davidson & Worrell, 2001), because doing so can reduce external suspicions about their environmental actions. In still other instances, regulatory requirements to publicly disclose information about toxic chemical releases have caused many companies to undertake new management strategies that reduce their environmental impacts (Konar & Cohen, 1997).

Other regulatory pressures relate to companies' desires to improve their relationships with regulators, because doing so may ensure their long-term viability, or at least make their ability to do business easier. For instance, by relying on their ISO 14001 certification, companies can form collaborative relationships with government more easily and explore more nonregulatory ways in which government can encourage greater environmental improvements (Andrews et al., 2003). These collaborations also can promote environmental learning, capacity building (Darnall & Edwards, in press), and increased trust between firms and regulators (Hoffman, 2000). Increased trust and access to regulators have additional benefits in that they can create greater opportunities to influence the environmental policy agenda.

Corporate-wide policies for certification therefore may represent a means by which companies can "signal" to regulators that they are committed to improving their environmental performance, thus avoiding legal sanction or indicating their willingness to cooperate with government officials.

Whichever the case, certification may be one way in which firms can obtain increased legitimacy from regulators. For all these reasons, we hypothesize that companies mandate ISO 14001 if they endure greater pressures from regulators.

*Hypothesis 1:* Organizations that endure stronger regulatory pressures are more likely to mandate, as opposed to merely encourage, ISO 14001 in their operational units.

*Market pressures.* In addition to regulatory pressures, market forces may influence a firm's decision to mandate ISO 14001 in each of its operational units. Over the past 10 years, market actors have been placing greater pressures on firms to consider their impacts to the natural environment (Hoffman, 2000). These increasing pressures are due to customers' becoming savvier about their purchasing decisions and to information becoming more available about companies' environmental activities (Arora & Gangopadhyay, 1995; Konar & Cohen, 1997). Consumers also have a strong role in establishing moral legitimacy and therefore may influence corporate-level decisions to mandate ISO 14001. For instance, studies a decade ago reported that 33% of adults claimed to have avoided buying products, at least occasionally, from firms with poor environmental records (Ottman, 1996). Since the 1990s, the movement of consumers to consider the environmental impacts of their purchasing decisions has gained substantial momentum and is continuing to alter consumers' basic habits (D'Souza, 2004). To meet with these changing preferences, environmentally conscious organizations are relying on ecolabeling to differentiate their products from rival competitors (D'Souza, 2004).

Markets also are responding by creating opportunities for environmentally friendly firms to demand premium prices for their products and services. Examples include the proliferation of organic produce markets, where U.S. consumers are willing to pay 20% to 50% more for organically produced food products; sales of organic products have grown steadily at an annual growth rate of 20% to 25% since 1996 (Barkley, 2002). Other examples are seen in the automobile markets, where hybrid cars cost \$3,000 to \$8,000 more than comparable cars (Walters, 2005) and where consumer demand for hybrid cars continues to rise. Consumers also are willing to pay price premiums for hotel services that are more environmentally friendly (Rivera, 2002). In characterizing the U.S. landscape, overall, 15% of consumers routinely pay more for green products and another 15% seek green products if they do not cost more (Ginsberg & Bloom, 2004).



Although these findings suggest that markets are creating opportunities for environmentally friendly firms, the majority of consumers still are not influenced by a company's proactive environmental practices. However, these same consumers may be persuaded to change their purchasing decisions if a company violates environmental laws or emits high levels of toxins (Prakash, 2000). As a consequence, corporate mandates for ISO 14001 may provide a vehicle for firms to signal to market participants that their environmental strategies adhere to or exceed generally accepted environmental standards. Doing so may lead to greater acceptance of the firm's strategic approach (DiMaggio & Powell, 1983) and insulate organizations from a competitor's criticisms (King & Lenox, 2001) that they may have a less desirable environmental strategy. Certification also may help companies develop an environmentally conscious reputation that invites patronage from consumers and generates opportunities for business with other organizations that value these principles (Darnall & Carmin, 2005). If successful, a corporation's organization-wide mandate for ISO 14001 therefore may confer moral legitimacy for its environmental practices. For these reasons, we hypothesize that organizations that endure stronger market pressures are more likely to mandate ISO 14001.

*Hypothesis 2:* Organizations that endure stronger market pressures are more likely to mandate, as opposed to merely encourage, ISO 14001 in their operational units.

Although institutional theory describes why firms might behave similarly, some researchers argue that firms are evolving and dynamic (Perrow, 1986) in that they respond to external pressures in numerous ways based on their access to resources and the capabilities that have developed over time (Oliver, 1997; Perrow, 1986). For example, companies may develop their environmental strategies in response to regulatory or market pressures, but their specific actions may differ. These heterogeneities are most likely due to variations in organizational resources and capabilities that are specific to the individual firm (Barney, 1991).

### **Complementary Resources and Capabilities**

According to the resource-based view (RBV) of the firm, resources are the physical assets that a firm owns, such as financial reserves (Amit & Schoemaker, 1993; Barney, 1991) and property, plant, equipment, and raw material stocks (Amit & Schoemaker, 1993; Russo & Fouts, 1997).

Intangible resources are nonphysical factors that increase organizational value (Collis & Montgomery, 1995; Grant, 1991; Wernerfelt, 1984). Brand name recognition, reputation, and patents are all forms of intangible assets. *Complementary* resources are the physical and intangible assets that facilitate strategic change. An organization's ability to leverage its complementary resources is critical to developing its environmental strategy (Russo & Fouts, 1997).

Prior research has emphasized the importance of innovative technologies (Arora & Cason, 1995) and capital investments in environmental technologies (Khanna & Damon, 1999) in helping organizations to improve their environmental performance. Based on their available capital, firms make appropriate decisions to invest in pollution control technologies or in other innovative processes that reduce their impact to the natural environment (Blackman, Afsah, & Ratunanda, 2004). Capital investments often are necessary for undertaking proactive environmental strategies (Lyon & Maxwell, 2002), such as ISO 14001 certification, because modifications to the firm's production processes may be required to accommodate greater pollution reductions. Firms that lack capital and innovative technologies still may be able to pursue a proactive environmental strategy by relying on external assistance from government-supported assistance programs (Darnall, 2003). External subsidies may come in the form of government-supported technical assistance, small grants for EMS design training, and consultant assistance (Darnall & Edwards, in press). By relying on these external resources, companies with otherwise lagging organizational capabilities may be more likely to adopt ISO 14001 (Darnall & Edwards, in press) and mandate it organization-wide.

*Hypothesis 3:* Organizations having stronger complementary resources are more likely to mandate, as opposed to merely encourage, ISO 14001 in their operational units.

An organization's competitive strategy depends on its ability to mobilize complementary resources toward developing productive capabilities (Collis & Montgomery, 1995; Grant, 1991). Capabilities are premised on knowledge-based practices that are complex socially, less tangible (Barney, 1991; Wernerfelt, 1984), and path dependent because they are a function of the company's unique learning and actions that accrue over time (Barney, 1991). To lead to sustained competitive advantage, these capabilities must be unique, tacit, specialized, or otherwise difficult to imitate or acquire (Oliver, 1997). Related to the natural environment, prior research suggests that a

company can achieve competitive advantage by developing its environmental proficiencies and continually improving them (Russo & Fouts, 1997; Sharma & Vredenburg, 1998). Continual improvement is critical, because competitors eventually will reproduce effective learning systems (Sharma & Vredenburg, 1998). Moreover, firms that are competent in continual improvement methods, such as quality management systems, also may be more proficient at transferring their basic team-focused knowledge toward encouraging organizational commitments in environmental activities (Darnall & Edwards, in press; Klassen, 2000). Quality management systems also promote lean manufacturing practices that encourage organizational efficiencies and reductions in input use that later could lead to pollution (King & Lenox, 2001). In fact, an EMS often is referred to as a total quality environmental management system (TQEM) because the philosophies are so closely aligned (Bansal & Hunter, 2003). For these reasons, we anticipate that organizations having organization-wide expertise in quality management systems are more likely to implement an organization mandate for ISO 14001.

*Hypothesis 4:* Organizations having more experience with quality management systems are more likely to mandate, as opposed to merely encourage, ISO 14001 in their operational units.

In addition to expertise in quality management systems, prior experience with basic pollution prevention practices may facilitate an organization's decision to mandate ISO 14001. Companies that utilize pollution prevention practices generally encourage employees to share their tacit knowledge of the company's internal operations in order to minimize the firm's impact to the natural environment (Hart, 1995). Organizations that want to develop creative ways to reduce their environmental harms also invest in training their employees about the techniques of pollution prevention, which can be leveraged toward adopting more advanced environmental management activities (Hart, 2005). Related to ISO 14001, companies that know their operational units utilize pollution prevention principles may have greater confidence to mandate ISO 14001, because their operational units already have basic competencies to support ISO 14001 implementation.

Even in firms that rely extensively on pollution prevention, ISO 14001 certification can have important behavioral and managerial impacts that improve their environmental performance (Randinelli & Vastag, 2000). These additional benefits accrue because EMSs generally involve rigorous internal assessments and formal structures to implement corrective actions

when problems arise (Department of Energy, 1998). Furthermore, ISO 14001 makes a greater attempt to formalize managerial commitment (Rondinelli & Vastag, 2000), community involvement, and external auditing (Coglianese & Nash, 2001). As a result, although many companies already employ pollution prevention principles and have a culture of waste minimization, adopting ISO 14001 may motivate them to take a more systematic approach to incorporating source reduction into all products and processes, thus institutionalizing existing pollution prevention programs by extending them and getting more value from what has already been developed. Consequently, we hypothesize

*Hypothesis 5:* Organizations having more experience with pollution prevention are more likely to mandate, as opposed to merely encourage, ISO 14001 in their operational units.

## Method

To test our hypotheses, we developed a list of U.S. ISO 14001–certified facilities by combining multiple sources. The Global International Quality Group (GIQ) maintains the most comprehensive list. Between 1996 and 1999, GIQ had recorded 916 ISO 14001–certified facilities. These data were combined with McGraw-Hill’s list of ISO 14001–certified facilities (1996–1998). GIQ and McGraw-Hill develop their lists by compiling registrars’ announcements of recently certified facilities. The GIQ list also includes facilities that self-identify their certification. Finally, we included facilities recognized by state environmental agencies as being ISO 14001 certified. After combining all three lists and removing duplicate records, a population of 972 unique U.S.-based facilities was identified as having certified to ISO 14001 by December 1999.

To identify the parent corporations of an ISO 14001–certified facility, each facility was researched using Dun & Bradstreet’s (D&B; 2000) *Who Owns Whom: North America 2000/01* and *Hoover’s Online* ([www.hoover-online.com](http://www.hoover-online.com)). These resources contain information on all facilities, divisions, and subsidiaries that operate in the United States and that belong to publicly traded corporations. Of the 972 facilities, we identified parent companies for 906, of which 348 were foreign owned and 558 were U.S. owned.<sup>2</sup> The facilities in the latter category were owned by 156 parent organizations, of which 138 were publicly traded corporations. Publicly traded organizations operating in Standard Industrial Classification (SICs) 10–49

accounted for 97% (135) of all U.S. ISO 14001–certified facilities and were the focus of this study. The remaining 3% of U.S. ISO 14001–certified facilities operated in service sectors (SICs 70-89) and were not included in this study for comparability reasons, because their operating structures and environmental impacts differ significantly from companies operating in the mining and construction (SICs 10-19), manufacturing (SICs 20-39) and transportation, communications, energy, and sanitary services (SICs 40-49).

All 135 firms were surveyed to determine which had corporate mandates and which did not. The survey was developed based on prior research by Andrews et al. (2003), which studied EMS adoption (ISO 14001 certified and not) within *facilities*. To accommodate a firm-level evaluation of ISO 14001–certified EMSs, Andrews et al.’s questionnaire was modified and reviewed by two management scholars. The survey was then pilot tested with three corporate environmental managers, which led to further modifications. The final survey was mailed in December 2000 to firms’ corporate environmental directors, and follow-up surveys were mailed 3 weeks later. Nonrespondents were sent up to five follow-up e-mail surveys, and data collection ended April 2001. The response rate was 39.3% ( $n = 53$ ), which is consistent with previous studies of firms’ environmental practices (e.g., Christmann, 2000; Delmas & Keller, 2005; Melnyk, Sroufe & Calantone, 2003).<sup>3</sup> Of these surveys, 49 had complete information and were included in our analysis.

### *Dependent Variable*

Before administering the survey, it was necessary to identify the different forms of corporations’ ISO 14001 policies. To do so, we relied on existing data contained in the National Database on Environmental Management Systems (NDEMS; <http://ndems.cas.unc.edu/>). NDEMS is the largest publicly accessible database containing survey data on EMS implementation practices for more than 80 U.S.-based facilities that participated in a 3-year nationwide EMS implementation program. The database also contains case studies for 10 NDEMS facilities. The NDEMS’ survey data assisted with an initial categorization and our qualitative assessment of the NDEMS case studies and follow-up discussions with pilot test firms revealed additional distinctions among firms that mandate ISO 14001. We identified two types of ISO 14001 “mandaters.” The first type was a partial mandate. In most cases, partial mandates consisted of firms requiring that some (but not all) of their divisions certify to ISO 14001. A division that certifies to ISO

14001 must have each of the facilities within that division certified as well. A fewer number of partial mandates consist of firms that require all their facilities to certify ISO 14001, but do not require that their divisions certify. The second type of ISO 14001 mandate consisted of firms that required all their divisions and facilities to certify to ISO 14001 (total mandate). A total mandate represents the strongest commitment toward organization-wide certification.<sup>4</sup> Firms that had any one of these ISO 14001 policies were considered mandaters.

Corporations with operational units that chose to certify to ISO 14001 in the absence of a corporate mandate were recognized as “encouragers.” Our qualitative assessment of the NDEMS data and our pilot test interviews indicated that there were three types of encouragers. The most common type actively encouraged their operational units to certify to ISO 14001 but did not mandate certification. The second type actively encouraged its operational units to reduce their impacts to the natural environment but did not formally suggest that ISO 14001 certification be considered as a means to do so. The third type did not actively promote proactive environmental management within its organization, although it did not prevent its operational units from certifying to ISO 14001. In each instance, the corporation played a role in developing a corporate culture (to varying degrees) that encouraged ISO 14001 certification within its operational units.

To determine whether the firms in our sample were mandaters or encouragers, we asked corporate environmental managers to check one of two boxes indicating whether the corporation (a) mandated or (b) encouraged its *divisions* to certify their EMSs to ISO 14001. Managers also were asked to check one of two boxes indicating whether the corporation (a) mandated or (b) encouraged its *facilities* to certify their EMSs to ISO 14001. Respondents that indicated that the corporation mandated certification in both its divisions and facilities were classified as having “total mandates.” Partial mandates consisted of firms that required (a) only their divisions to certify to ISO 14001 (division mandate) or (b) only their facilities to certify to ISO 14001 (facility mandate). Firms were then asked what factors influenced their ISO 14001 policies. All three categories of mandaters were compared empirically to encouragers.

### *Explanatory Variables*

To measure regulatory pressures, we asked whether the firm’s ISO 14001 policy was influenced by the belief that ISO 14001 certification would improve the company’s environmental compliance (Hoffman, 2000).

Firms also were asked whether the decision to mandate or encourage ISO 14001 was motivated by the hope that certification might lead to future regulatory benefits such as improved relationships with regulators (Coglianese & Nash, 2001). Respondents replied using a 3-point ordinal scale to indicate whether these factors had either a *high influence*, *moderate influence*, or *low influence*. The hazard of using a 3-point scale rather than a typical 5-point scale was that it reduced variance in our independent variables. However, in general the bias was downward, suggesting that if statistically significant relationships were found, additional evidence would be provided about the strength of the relationship between the dependent and independent variables (Hardin & Hilbe, 2001).

To measure institutional pressures related to markets, four pressures were considered. Because some consumers recognize green firms as being more legitimate in that they are willing to pay price premiums for their services (Rivera, 2002) and products (Ginsberg & Bloom, 2004; Walters, 2005), we asked whether the firm's ISO 14001 policy was influenced by the belief that certification (a) might increase their revenues or (b) might provide a competitive advantage. To determine whether firms with corporate-wide mandates were striving toward greater external acceptance for their environmental practices (Bansal & Clelland, 2004), we asked whether the firm's ISO 14001 policy was influenced by the belief that certification (c) might be an important public relations device and (d) might be a valuable marketing tool. Respondents replied using the same 3-point ordinal scale to indicate whether the items had either a high influence, moderate influence, or low influence.

Firms' complementary resources were measured by asking corporate environmental managers whether they believed that prior investments in innovative technologies (Arora & Cason, 1995), capital investments (Blackman et al., 2004; Khanna & Damon, 1999), and government-provided technical assistance (Darnall & Edwards, in press) had a high influence, moderate influence, or low influence on their ISO 14001 certification policy.

Responses to all nine questions were combined in a common factor analysis using varimax rotation. An analysis of the factor loadings yielded three distinct factors accounting for firms' regulatory pressures, market pressures, and complementary resources (see Table 1). Cronbach's alphas for the three factors were .76, .87, and .84, respectively, meeting Nunnally's (1978) criteria for internal reliability.

Firms' complementary capabilities were measured by their quality management system expertise and pollution prevention experience. Firms that mandated ISO 9000 in their operational units were considered to have stronger, more formalized, continuous improvement expertise related to

**Table 1**  
**Factor Analysis Results**

Constructs	Factors		
Regulatory pressure			
ISO 14001 may improve our environmental compliance.	<b>.92</b>	.00	-.01
ISO 14001 may lead to regulatory benefits.	<b>.76</b>	.38	.27
Market pressure			
ISO 14001 may increase our market share.	.00	<b>.85</b>	.17
ISO 14001 may be a valuable public relations tool.	.09	<b>.82</b>	.30
ISO 14001 may provide a competitive advantage.	.24	<b>.82</b>	.22
ISO 14001 may increase our revenues.	.17	<b>.76</b>	.07
Complementary resources			
Government-provided technical assistance made ISO 14001 attractive.	.24	.15	<b>.81</b>
Prior innovative technology investments made ISO 14001 attractive.	.01	.29	<b>.86</b>
Prior capital investments made ISO 14001 attractive.	.07	.12	<b>.90</b>
Cronbach's alpha	.76	.87	.84

Note: ISO = International Organization for Standardization.

product quality because they had acquired the internal knowledge, proficiencies, and skills to support their corporate directives (Kitazawa & Sarkis, 2000). Basic pollution prevention competencies were assessed by whether firms had established a corporate-wide pollution prevention plan prior to their ISO 14001 decision. Firms that had established corporate-wide pollution prevention plans were believed to have more organization-wide pollution prevention experience than companies without such plans (Henriques & Sadowsky, 1996).

To address firm heterogeneity, we included a variable to control for firm size. Firm size was measured by a count of employees (in thousands) and was obtained from *Hoover's Online*. To control for industry effects, industry dummies representing SIC codes 10-19 (mining and construction), 20-39 (manufacturing) and 40-49 (transportation, communications, energy, and sanitary services) were included. The mining and construction sector was our omitted industry dummy variable. Sample size constraints prevented us from creating more precise industry dummies.



### *Empirics*

Three logistic regression models were estimated to account for whether firms had implemented a total mandate, a division mandate, and a facility mandate. The generalized form of the regressions was as follows:

$$P_{it} = \beta_1(\text{regulatory pressures})_i + \beta_2(\text{market pressures})_i + \beta_3(\text{complementary resources})_i + \beta_4(\text{corporate ISO 9000})_i + \beta_5(\text{corporate pollution prevention plan})_i + \beta_6(\text{firm size})_i + \sum \beta_7(\text{industry dummies})_i$$

where  $P_{it}$  does not itself represent a decision of firm  $i$  to mandate ISO 14001 but the probability of doing so based on the expected net benefit of the firm's decision. Because these benefits are not observed, the observed decision serves as an indicator (Welch, Mazur, & Bretschneider, 2000) of whether the firm believes that there is a net benefit of mandating ISO 14001 related to the explanatory variables. Table 2 presents a correlation matrix. The table also includes means, standard deviations, and variance inflation factors for the independent variables. Low correlations among the independent variables (< 60%) and low variance inflation factors (< 2.0) revealed that multicollinearity was not present (Kennedy, 1997) in our empirical model.

## **Results**

The results of our survey showed that a significant number of firms mandated ISO 14001 across their operational units. Just less than half of the firms (45%, 22 total) mandated that their facilities certify to ISO 14001. All but 6 of these firms also had instituted a division mandate. Approximately 35% (17 total) of the sample required that their divisions certify to ISO 14001, and all but 1 of them also had instituted a facility mandate. As such, about one third of the firms (33%, 16 total) mandated that all their divisions and facilities certify to ISO 14001. Just greater than half (55%, 27 total) of the firms did not require either their divisions or their facilities to certify their EMSs to ISO 14001.

Table 3 describes the results of our logistic regressions. The pseudo  $R^2$  statistics indicate that between 29% and 53% of the variance in the sample's decisions to mandate ISO 14001 was explained by the hypothesized variables included in the models. The goodness of fit statistic for a particular model is  $-2$  times the log likelihood of that model, and all were statistically significant. All of the estimated coefficients were positive, and most were statistically significant.

**Table 2**  
**Spearman Correlation Matrix<sup>a</sup>**

	<i>M</i>	Minimum	Maximum	<i>SD</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Regulatory pressure	-0.026	-1.92	1.43	1.00	1.00								
(2) Market pressure	-0.012	-2.06	1.78	0.99	0.31	1.00							
(3) Complementary resources	0.024	-1.34	2.36	0.99	0.26	0.43	1.00						
(4) ISO 9000	0.48	0	1	0.51	-0.03	-0.12	0.06	1.00					
(5) Pollution prevention plan	0.62	0	1	0.49	-0.13	0.04	0.13	0.03	1.00				
(6) Employees (in thousands)	55.45	0.07	596	95.8	0.11	0.03	-0.25	0.04	0.12	1.00			
(7) SIC 30-35	0.26	0	1	0.44	-0.22	0.23	0.27	0.01	0.02	-0.18	1.00		
(8) SIC 35-39	0.34	0	1	0.48	-0.11	-0.16	-0.14	0.10	-0.10	0.31	-0.42	1.00	
(9) SIC 40-49	0.10	0	1	0.30	0.22	0.24	0.12	-0.31	-0.14	0.03	-0.20	-0.24	1.00

Note: ISO = International Organization for Standardization; SIC = Standard Industrial Classification.

a. Variance inflation factors for variables 1–9 were 1.21, 1.21, 1.26, 1.28, 1.29, 1.30, 1.69, 1.83, and 1.90, respectively.

**Table 3**  
**Predicting Firms' Corporate International Organization for Standardization (ISO) 14001 Policies**

Explanatory Variables	Type of ISO 14001 Mandate					
	Total Mandate— Organization-wide <sup>a</sup> , <i>n</i> = 43		Partial Mandate— Division-Level Mandate <sup>b</sup> , <i>n</i> = 44		Partial Mandate— Facility-Level Mandate <sup>c</sup> , <i>n</i> = 49	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Regulatory pressures	2.35***	0.92	2.20***	0.88	0.96**	0.41
Market pressures	1.62**	0.69	1.52**	0.65	0.49	0.39
Complementary resources	1.71***	0.65	1.78***	0.67	0.96**	0.41
ISO 9000	1.83*	1.18	2.01*	1.15	1.45*	0.78
Pollution-prevention plan	1.47	1.13	1.00	1.01	0.13	0.77
Employees	0.01	0.01	0.01	0.01	0.01	0.01
SIC 30-35	-2.05	1.59	-1.94	1.55	-0.49	1.08
SIC 36-39	-0.16	1.38	0.22	1.30	-0.25	0.92
SIC 40-49	-4.18*	2.44	-4.00*	2.41	-2.49	1.61
Constant	-2.32*	1.38	-2.26*	1.37	-0.63*	0.92
Log likelihood	13.29***		14.21***		19.68***	
Pseudo <i>R</i> <sup>2</sup>	.53		.52		.29	

a. A total mandate is composed of firms that had mandates for ISO 14001 both at the division and at the facility level. Omitted from the analysis are firms reported having division-level mandates but not facility-level mandates and firms that reported having facility-level mandates but not division-level mandates.

b. Analysis excludes six firms that reported having a facility-level mandate but not a division-level mandate.

c. Analysis excludes one firm that reported having a division-level mandate but not a facility-level mandate.

\* $p \leq .10$ . \*\* $p \leq .05$ . \*\*\* $p \leq .01$ .

In evaluating the individual coefficients, our results showed that regulatory pressures in the form of improving the company's environmental compliance and anticipating future regulatory benefits were an important predictor of firmwide ISO 14001 mandates (Model 1), of mandates at the division level (Model 2), and of facility mandates (Model 3). These findings provide evidence in support of Hypothesis 1, which states that organizations that endure stronger regulatory pressures are more likely to mandate, as opposed to merely encourage, ISO 14001 in their operational units. Market pressures predicted companies' decisions to mandate ISO 14001 organization-wide and within their divisions. Firms' decisions to mandate ISO 14001 were predicted by the belief that certification (a) might increase their revenues, (b) might provide a competitive advantage, (c) might be an important public relations device, and (d) might be a valuable marketing tool. These findings offer evidence for Hypothesis 2, which states that organizations that endure stronger market pressures are more likely to mandate, as opposed to merely encourage, ISO 14001 in their operational units.

Firms that had all three types of mandates were more likely to have stronger complementary resources that facilitated their corporate ISO 14001 policies in innovative technologies, capital investments, and external resources from government-provided technical assistance. Combined, these results offer support for Hypothesis 3, which states that access to resources influences firms to mandate ISO 14001 in their operational units. In evaluating firms' continuous improvement capabilities, organization-wide expertise with ISO 9000 predicted firms' ISO 14001 mandates in all three models (Hypothesis 4). However, firms that had a mandate for ISO 14001 were no more likely to have organization-wide experience with pollution prevention principles, which contradicts Hypothesis 5.

With respect to our control variables, firm size had no effect in that the mean number of employees did not differ among mandaters and encouragers. Finally, firms within SICs 40-49 (transportation, communications, energy, and sanitary services) were less likely to impose total mandates and division mandates than firms in mining and construction sectors.

## **Discussion**

This study relied on institutional theory and RBV to investigate the reasons why U.S. firms mandate ISO 14001 across each of their operational units. It offers three significant research contributions. First, the results demonstrate that although ISO 14001 is implemented at the facility level, the parent company often plays a fundamental role in certification decisions. The

strongest type of corporate involvement—an organization-wide mandate—was prevalent in one third of the firms included in this study, and almost half of U.S. firms had some type of corporate mandate for ISO 14001 certification. These findings support the notion that facility-level strategic actions often are the result of decisions made at the firm level (Oliver, 1991). As such, studying strategic environmental choices at the facility level may have less importance for some types of environmental decisions. Even in the absence of a corporate mandate, parent companies may still influence facility-level environmental activities simply by promoting a corporate culture that encourages facility-level innovation related to the natural environment. Without considering the central relationship parent companies have in facility-level certification decisions, and possibly other environmental activities, the results of this study suggest that scholars may reach inappropriate conclusions about the reasons why facilities adopt proactive environmental strategies.

The second contribution of this research is that it informs the debate regarding the competing theoretical reasons why firms undertake proactive environmental strategies. Prior research drawing on aspects of institutional theory has shown that firms adopt voluntary environmental practices when confronted with pressures from regulators and markets (Arora & Cason, 1995; Khanna & Damon, 1999). However, studies relying on RBV conclude that organizations with stronger complementary capabilities undertake proactive environmental strategies (Christmann, 2000; Hart, 1995; Rugman & Verbeke, 1998; Russo & Fouts, 1997; Sharma & Vredenburg, 1998). Our findings offer evidence that both perspectives have merit in explaining why firms mandate ISO 14001 in their operational units. Related to institutional theory, regulatory pressures associated with achieving compliance and anticipating future regulatory benefits predicted whether firms instituted centralized policies mandating ISO 14001 certification. Market pressures also were important in explaining corporate-level ISO 14001 decisions in that mandaters were influenced by the possibility of increasing revenues, achieving competitive advantage, improving public relations, and improving their marketing abilities. These findings offer support for the notion that companies adopt proactive environmental strategies to derive greater external legitimacy (Bansal & Clelland, 2004).

However, this study also provides evidence that an organization's complementary resources and capabilities facilitate the adoption of more advanced environmental practices. More specifically, quality management systems (Bansal & Roth, 2000; King & Lenox, 2001; Kitazawa & Sarkis, 2000), innovative technologies (Arora & Cason, 1995), and capital investments

(Blackman et al., 2004; Khanna & Damon, 1999) were embedded in firms' ISO 14001 mandate decisions. Companies that did not have these complementary resources and capabilities were less likely to adopt an organization-wide mandate for ISO 14001. As such, an appreciation of firms' complementary resources and capabilities, in addition to institutional factors, provides a more comprehensive perspective of the complex reasons why firms institute ISO 14001 mandates.

It is important to note that corporations that mandated ISO 14001 in their operational units were no more likely to require pollution prevention plans than companies that merely encouraged ISO 14001. That is, both mandaters and encouragers relied on centralized pollution prevention plans to a similar extent. Although organizations with pollution prevention expertise can more readily implement ISO 14001, and do so at lower cost (Darnall & Edwards, *in press*), the firms in this study appear to view ISO 14001 as having little value added over their corporate-wide pollution prevention policies.<sup>5</sup>

Future research would benefit from understanding how institutional theory and RBV interact with one another. For instance, it would be interesting to know whether institutional pressures give rise to resources and capabilities that then lead to organizational mandates for environmental action. Alternatively, a company's weak resources and capabilities may explain why a firm endures stronger institutional pressures to address its environmental harms, which then give rise to organizational mandates for environmental action. The nature of our data limits us from assessing these temporal issues. However, future scholarship would benefit significantly by examining these relationships further.

The third contribution of this research is that our findings offer evidence regarding why firms see value in the ISO 14001 standard and why it is becoming so recognized worldwide. ISO 14001 has the potential to be utilized by a tremendous number of firms because it is applicable to all industries and countries. For this reason, it has the potential to affect more firms globally and affect more facility operations than any other environmental certification program. Our findings suggest that the increased global diffusion of ISO 14001 may be due to companies' need to appear legitimate in the eyes of external stakeholders who affect their long-term survival and competitiveness. Companies also appear to be relying on ISO 14001 to create more strategic value from their existing complementary resources and capabilities in an effort to create competitive advantage.

This study has some limitations that are important to acknowledge. Our research was conducted in the 5 years after the ISO 14001 standard was institutionalized (1996-2000). Beginning in 2001, companies—such as

Ford Motor Company, General Motors, and others—began requiring that at least one manufacturing site within each firm they do business with be ISO 14001 certified by the end of 2001 and that by 2002 all manufacturing sites within each firm they do business with be certified. Coercive supplier mandates such as these do not allow us to project the findings of this research to all future certification decisions. However, by isolating this study to the years when supplier mandates had not yet been instituted, we have simplified the research design to focus on the more nuanced reasons why companies would strive to be early mandaters of ISO 14001.

Despite this advantage, coercive pressures in the supply chain are important issues for future research to explore, especially because buyers' mandates for ISO 14001 may force many companies to certify when they lack the complementary resources and capabilities that foster continual environmental improvement over time. These companies also may develop ISO 14001 EMSs that have less ambitious environmental goals and therefore may not improve their environmental performance any more than noncertified companies. Future research should consider these issues, especially as we begin to evaluate the extent that ISO 14001 and other advanced environmental strategies improve the natural environment over time. Other issues to consider include how firms' motivations to mandate or encourage ISO 14001 differ from firms that have no operational units that are certified to the standard. Given the central role of the firm in ISO 14001 certification decisions, facility-level motivations may have less importance. The framework presented here suggests that nonadopters would have even *weaker* external pressures and *fewer* complementary capabilities than firms that mandate or encourage ISO 14001 certification. These potential differences also have logical extensions toward hypothesis testing for environmental performance changes over time, as firms that achieve greater levels of environmental performance also may have greater institutional pressures and higher order learning proficiencies that lead to greater environmental improvements.

## Conclusion

Because of its wide applicability and recognition, ISO 14001 has the potential to affect more firms globally than any other certification program. Since the standard is voluntary, requires the commitment of significant resources, and has potential social and economic benefits, certification to ISO 14001 creates at least the appearance that a company is trying to be socially responsible. This study demonstrates the central role of parent

companies in facility-level certifications and suggests that studying strategic environmental decisions at the firm level may be critical to understanding why facilities undertake proactive environmental strategies.

## Notes

1. This changed when Ford Motor Company and General Motors (GM) required their suppliers to be International Organization for Standardization (ISO) 14001 certified, affecting thousands of suppliers with manufacturing and servicing facilities. Ford required suppliers to certify at least one manufacturing site to ISO 14001 by the end of 2001 and all manufacturing sites shipping products to Ford by 2003, and GM required certification by 2002. Since then, many other U.S. corporations have instituted similar supply chain mandates.

2. The unidentified owners of the 66 remaining facilities not listed in either Dun & Bradstreet or *Hoover's Online* were most likely private companies of either U.S. or foreign ownership.

3. Response rates were 20.1%, 11.2%, and 10.4%, respectively.

4. In still other instances, firms required that their subsidiaries also certify to ISO 14001. However, subsidiary-level certification was uncommon (< 5%).

5. Thanks are due to an anonymous reviewer for raising these points.

## References

- Adams, R. (1999). ISO 14001: A key ingredient of competitive advantage. *Environmental Law and Management, 11*, 103-114.
- Allenby, B. (1991, September). Design for environment: A tool whose time has come. *SSA Journal*, pp. 6-9.
- Amit, R., & Schoemaker, P. (1993). Strategic assets and organizational rent. *Strategic Management Journal, 14*, 33-46.
- Andrews, R. N. L., Amaral, D., Darnall, N., Gallagher, D., Edwards, D., Jr., Hutson, A., et al. (2003). *Environmental management systems: Do they improve performance?* Chapel Hill: University of North Carolina at Chapel Hill, Department of Public Policy, and Environmental Law Institute.
- Anton, W. R. Q., Deltas, G., & Khanna, M. (2004). Incentives for environmental self-regulation and implications for environmental performance. *Journal of Environmental Economics and Management, 48*, 632-654.
- Arora, S., & Cason, T. N. (1995). Why do firms volunteer to exceed environmental regulations? Understanding participation in EPA's 33/50 program. *Land Economics, 72*, 413-432.
- Arora, S., & Gangopadhyay, S. (1995). Toward a theoretical model of voluntary overcompliance. *Journal of Economic Behavior and Organization, 28*, 289-309.
- Backman, J. (1975). *Social responsibility and accountability*. New York: New York University Press.
- Bansal, P., & Clelland, I. (2004). Talking trash: Legitimacy, impression management and unsystematic risk in the context of the natural environment. *Academy of Management Journal, 47*, 93-103.



- Bansal, P., & Hunter, T. (2003). Strategic explanations for the early adoption of ISO 14001. *Journal of Business Ethics, 46*, 289-299.
- Bansal, P., & Roth, K. (2000). Why companies go green: A model of ecological responsiveness. *Academy of Management Journal, 43*, 717-736.
- Barkley, A. (2002, August). *Organic food growth: Producer profits and corporate farming*. Paper presented at the Risk and Profit Conference, Department of Agricultural Economics, Kansas State University, Manhattan.
- Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*, 99-120.
- Blackman, A., Afsah, S., & Ratunanda, D. (2004). How do public disclosure pollution control programs work? Evidence from Indonesia. *Human Ecology Review, 11*, 235-246.
- Christmann, P. (2000). Effects of "best practices" of environmental management on cost competitiveness: The role of complementary assets. *Academy of Management Journal, 43*, 663-880.
- Coglianesi, C., & Nash, J. (Eds.). (2001). *Regulating from the inside: Can environmental management systems achieve policy goals?* Washington, DC: Resources for the Future.
- Collis, D. J., & Montgomery, C. A. (1995). Competing on resources: Strategy in the 1990's. *Harvard Business Review, 73*, 118-128.
- Darnall, N. (2003). Motivations for participating in a voluntary environmental initiative: The multi-state working group and EPA's EMS pilot program. In S. Sharma & M. Starik (Eds.), *Research in corporate sustainability* (pp. 123-154). Boston: Edward Elgar.
- Darnall, N., & Carmin, J. (2005). Greener and cleaner? The signaling accuracy of U.S. voluntary environmental programs. *Policy Sciences, 38*(2/3), 71-90.
- Darnall, N., & Edwards, D., Jr. (2006). Predicting the cost of environmental management system adoption: The role of capabilities, resources and ownership structure. *Strategic Management Journal, 27*, 301-20.
- Davidson, W. N., & Worrell, D. L. (2001). Regulatory pressure and environmental management infrastructure and practices. *Business and Society, 40*, 315-342.
- Delmas, M. (2002). The diffusion of environmental standards in Europe and in the United States. *Policy Sciences, 35*, 91-119.
- Delmas, M., & Keller, A. (2005). Free riding in voluntary environmental programs: The case of the U.S. EPA WasteWise program. *Policy Sciences, 38*, 91-106.
- Deming, W. E. (1986). *Out of the crisis*. Cambridge, MA: MIT Press.
- Department of Energy. (1998). *Environmental management systems: Institutionalizing pollution prevention*. Washington, DC: Author, Office of Policy EH-4.
- DiMaggio, P. W., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*, 147-160.
- D'Souza, C. (2004). Ecolabel programmes: A stakeholder (consumer) perspective. *Corporate Communications, 9*, 179-188.
- Dun & Bradstreet. (2000). *Who owns whom: North America 2000/01* (Vol. 2). London: Author.
- Ginsberg, J. M., & Bloom, P. N. (2004). Choosing the right green marketing strategy. *Sloan Management Review, 46*, 79-84.
- Grant, R. M. (1991). The resource-based theory of competitive advantage. *California Management Review, 33*, 114-135.
- Hardin, J., & Hilbe, J. (2001). *Generalized linear models and extensions*. College Station, TX: STATA Press.
- Hart, S. L. (1995). A natural resource-based view of the firm. *Academy of Management Review, 20*, 986-1014.

- Hart, S. L. (2005). *Capitalism at the crossroads: The unlimited business opportunities in solving the world's most difficult problems*. Upper Saddle River, NJ: Wharton School Publishing.
- Hay, R. D., Gray, E. R., & Gates, J. E. (1976). *Business and society*. Cincinnati, OH: Southwestern.
- Henriques, I., & Sadorsky, P. (1996). The determinants of an environmentally responsive firm: An empirical approach. *Journal of Environmental Economics and Management*, 30, 381-395.
- Hoffman, A. (1997). *From Heresy to dogma: An institutional history of corporate environmentalism*. San Francisco: New Lexington Press.
- Hoffman, A. (2000). *Competitive environmental strategy: A guide to the changing business landscape*. Washington, DC: Island Press.
- Hoffman, A., & Ventresca, M. J. (Eds.). (2002). *Organization, policy and the natural environment: Institutional and strategic perspectives*. Stanford, CA: Stanford University Press.
- Kennedy, P. (1997). *A guide to econometrics* (3rd ed.). Cambridge, MA: MIT Press.
- Khanna, M., & Anton, W. R. Q. (2002). Corporate environmental management: Regulatory and market-based incentives. *Land Economics*, 78, 539-558.
- Khanna, M., & Damon, L. A. (1999). EPA's voluntary 33/50 program: Impact on toxic releases and economic performance of firms. *Journal of Environmental Economics and Management*, 37, 1-25.
- King, A., & Lenox, M. (2001). Who adopts management standards early? An examination of ISO 14001 certifications. In D. Nagao (Ed.), *Best paper proceedings: Fifty-ninth meeting of the Academy of Management* (pp. A1-A6). Washington, DC: Academy of Management.
- King, A., Lenox, M., & Terlaak, A. (2005). The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard. *Academy of Management Journal*, 48, 1091-1106.
- Kitazawa, S., & Sarkis, J. (2000). The relationship between ISO 14001 and continuous source reduction programs. *International Journal of Operations and Production Management*, 20, 225-248.
- Klassen, R. D. (2000). Exploring the linkage between investment in manufacturing and environmental technologies. *International Journal of Operations and Production Management*, 20, 127-147.
- Kollman, K., & Prakash, A. (2001). Green by choice? Cross-national variations in firms' responses to EMS-based environmental regimes. *World Politics*, 53, 399-430.
- Konar, S., & Cohen, M. A. (1997). Information as regulation: The effect of community right to know laws on toxic emissions. *Journal of Environmental Economics and Management*, 32, 109-124.
- Lyon, T. P., & Maxwell, J. (2002). Voluntary approaches to environmental regulation: An overview. In M. Franzini & A. Nicita (Eds.), *Economic institutions and environmental policy* (pp. 142-174). Aldershot, UK: Ashgate.
- Makower, J. (1993). *The E factor: The bottom-line approach to environmentally responsible business*. New York: Random House.
- Manne, H., & Wallich, H. (1972). *The modern corporation and social responsibility*. Washington, DC: American Enterprise Institute.
- Massey, J. (2001). Managing organizational legitimacy: Communication strategies for organizations in crisis. *Journal of Business Communication*, 38, 153-183.

- Melnyk, S. A., Sroufe, R. P., & Calantone, R. L. (2003). Assessing the impact of environmental management systems on corporate and environmental performance. *Journal of Operations Management*, 21, 329-351.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- Oliver, C. (1991). Strategic responses to institutional pressures. *Academy of Management Journal*, 16, 145-179.
- Oliver, C. (1997). Sustainable competitive advantage: Combining institutional and resource-based views. *Strategic Management Journal*, 18, 679-713.
- Ottman, J. (1996). Green consumers not consumed by eco-anxiety. *Marketing News*, 30, 13.
- Peglau, R. (2005). *ISO 14001 certification of the world*. Berlin, Germany: Federal Environmental Agency.
- Perrow, C. (1986). *Complex organizations: A critical essay*. New York: Random House.
- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations*. New York: Harper & Row.
- Potoski, M., & Prakash, A. (2005). Covenants with weak swords: ISO 14001 and firms' environmental performance. *Journal of Policy Analysis and Management*, 24, 745-769.
- Prakash, A. (2000). Responsible care: An assessment. *Business and Society*, 39, 183-209.
- Pun, K. F., & Hui, L. K. (2001). An analytical hierarchy process assessment of the ISO 14001 environmental management system. *Integrated Manufacturing Systems*, 12, 333-345.
- Rivera, J. (2002). Assessing a voluntary environmental initiative in the developing world: The Costa Rican certification for sustainable tourism. *Policy Sciences*, 35, 333-360.
- Rondinelli, D. A., & Vastag, G. (2000). Panacea, common sense, or just a label? The value of ISO 14001 environmental management systems. *European Management Journal*, 18, 499-510.
- Rugman, A. M., & Verbeke, A. (1998). Corporate strategies and environmental regulations: Organizing framework. *Strategic Management Journal*, 19, 363-375.
- Russo, M. V., & Fouts, P. A. (1997). A resource-based perspective on corporate environmental performance and profitability. *Academy of Management Journal*, 40, 534-559.
- Scott, W. R. (2001). *Institutions and organizations* (2nd ed.). Thousand Oaks, CA: Sage.
- Sharma, S., & Vredenburg, H. (1998). Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. *Strategic Management Journal*, 19, 729-753.
- Shireman, W. (2003). *A measurement guide to productivity: 50 powerful tools to grow your triple bottom line*. Tokyo: Asian Productivity Organization.
- Shrivastava, P. (1995). Ecocentric management for a risk society. *Academy of Management Review*, 20, 118-137.
- Suchman, M. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, 20, 571-610.
- Walters, P. (2005, December 9). *Cities question the costs of hybrid cars*. Philadelphia Associated Press. Retrieved from <http://abcnews.go.com/US/wireStory?id=1389394>
- Welch, E. W., Mazur, A., & Bretschneider, S. (2000). Voluntary behavior by electric utilities: Levels of adoption and contribution of the climate challenge program to the reduction of carbon dioxide. *Journal of Public Policy Analysis and Management*, 19, 407-426.
- Welford, R. (1992). Linking quality and the environment: A strategy for the implementation of environmental management systems. *Business Strategy and the Environment*, 1, 25-34.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5, 171-180.

Willig, J. T. (Ed.). (1994). *Environmental TQM* (2nd ed.). New York: McGraw-Hill.

**Nicole Darnall** is an assistant professor of environmental science and policy at George Mason University. Her research interests are in the areas of corporate sustainability, environmental policy innovation, and the role of external stakeholders in the environmental governance of enterprise and government (e-mail: [ndarnall@gmu.edu](mailto:ndarnall@gmu.edu)).