ENVIRONMENTAL SIGNALING AND EMS ADOPTION: FACILITY MOTIVATIONS AND PUBLIC POLICY IMPLACATIONS

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ABSTRACT

This research explores theoretically the factors that contribute to a facility's decision to signal its environmental strategy. It develops an institutional and organizational framework of facilities' signaling decisions and then applies it to the environmental management system (EMS) context using data from the National Database on EMSs. Motivations for EMS adoption are evaluated for three types of organizations: publicly traded facilities, privately owned facilities, and government facilities. The results show that drivers for EMS adoption differ for all three types of organizations. A common theme among them, however, is the importance of regulatory pressures in facilities' decisions to adopt an EMS, which supports the idea that EMS adoption develops in the "shadow of regulation." It also provides evidence that government support in the form of technical assistance and regulatory benefits play a strong role in motivating facilities to adopt EMSs. These findings point to the potential importance that policy incentives may offer in encouraging widespread adoption of EMSs, especially for privately owned and government facilities.

INTRODUCTION

Over the past decade, U.S. policy makers have given increasing attention to market-based instruments for environmental protection, including various types of voluntary environmental programs. These programs represent a departure from government's traditional environmental regulatory role, which is largely characterized by its uniform pollution standards, requirements for specific forms of pollution control technologies for an entire industry, and punishment for enterprises that deviate from these mandates. Critics of this framework argue that facilities operating within it have little flexibility to comply with pollution regulations and often require costly capital investments and result in less efficient outcomes.

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Since the late 1980s, the U.S. Environmental Protection Agency (EPA) has broadened its single-armed approach to monitoring, permitting, and enforcement to include a second conceptual approach that rewards good behavior. This new approach incorporates into EPA's various media programs incentives for environmental stewardship and in large part relies on self-enforcement and incentives for good environmental behavior. Self-enforcement is increasingly being used within the regulatory sector and is particularly desirable from an efficiency perspective, because government in theory is able to spend fewer resources monitoring companies that are ahead of the regulatory curve and instead focus its attention to facilities that fail to achieve their regulatory obligations.

A failure of the current self-monitoring model, however, is the lack of environmental signals that help regulators and the interested public to determine which facilities are in compliance with environmental laws, because all facilities are generally viewed in the same light. The existing EPA established signals, moreover, are insufficient as self-reported compliance and toxic emissions data are validated two or more years after a violation or emission release.[2] The result of this framework is that market participants make judgments about a facility's compliance and pollution emissions based on data that are largely outdated, and only a relatively few participants are willing to incur the transaction costs of becoming informed.

EPA is addressing some of these issues by designing programs that attempt to identify which facilities might be better environmental performers than others. These programs include EPA's Performance Track, Green Lights Program, Common Sense Initiative, Project XL, Energy Star, 33/50 Program, and Wa$te Wi$e. In each of these programs, *participation* may be the relevant signal to regulators that a facility is on the path to fulfilling or has already fulfilled its regulatory obligations. While compliance is not necessarily guaranteed, the likelihood that participating facilities have a heightened awareness of their regulatory obligations may be greater than for non-participating facilities.

To date, however, there is little empirical information that sheds light on the voluntary activities that facilities are undertaking to manage their environmental impacts and why signaling these activities to the market might be attractive. Instead, recent research has focused more simply on why facilities choose to participate in a particular environmental program, arguing that participation is a function of the economic costs and benefits of doing so. While this suggestion is not necessarily incorrect, it ignores the various institutional and organizational pressures that comprise this economic rationale. Perhaps most importantly, previous literature on facilities' voluntary environmental activities has ignored the organization's environmental compliance history, which may likely play a significant role in their decision to send "green" signals so that they may change their tarnished image of the past.

[2] Data on a facility's toxic emissions, for example, are not publicly available until nearly two years after the pollutants are released into the natural environment. This lag time is due in part to EPA's reporting requirements and the time that it takes EPA to process the information and make it available in usable form.

The practical need for such information is great. Understanding the external and internal factors that motivate businesses to signal their environmental strategy is important to policy makers, since the effectiveness of their voluntary environmental programs depends in large part on how corporations respond to them. Moreover, as regulators increasingly expand their basket of market-based voluntary programs, it will be important for them to understand which facilities are more likely to participate in them.

This research explores theoretically the factors that contribute to a facility's decision to signal its environmental strategy. It evaluates the institutional framework of facilities' decisions to signal their greenness and relates this decision to their organizational capabilities. These influences are then evaluated using data from the National Database on Environmental Management Systems to analyze facilities' decisions to send a green signal by adopting an EMSs.

THE INSTITUTIONAL FRAMEWORK OF ENVIRONMENTAL SIGNALING

Only recently has much attention been placed on understanding why a facility might signal their environmental strategy by participating in a voluntary environmental program. The lack of research on the topic may in part be attributed to conventional economic arguments that organizations should invest in environmental activities only to the point that they do not affect their financial performance. Interpreted more strictly, investment beyond that required by the current regulatory structure is detrimental to the organization's financial performance and a constraint on its financial opportunities (Christiansen and Haveman, 1981; Conrad and Morrison, 1989; Denison 1979; Jaffe and Palmer 1997; Lave 1973; Norsworthy, Harper and Kunze, 1979; Robinson 1975). These arguments suggest that there is little justification for a facility to signal its greenness.

Yet many facilities are sending green signals to the market, to regulators, and to the public. Have these facilities acted against conventional economic wisdom? Not necessarily. Indeed, recent research in management theory indicates that facilities may benefit substantially by better managing their environmental impacts (Hart and Ahuja, 1996; Henderson and Mitchell 1997; Klassen and McLaughlin 1996; Walley and Whitehead, 1994) and signaling their proactive environmental activities. In fact, proactive environmental management may develop in the "shadow of regulation," and the presence of the regulatory system may foster facilities' decisions to consider environmental stewardship goals as part of their profit maximizing criteria (Gallagher, Darnall, and Andrews et al. 1999).

The multiple factors that prompt facilities to send green signals may be classified into two forms: external drivers and internal drivers. External drivers include pressures such as regulatory, market, resource, and social influences. Internal drivers include factors such as organization's management system capabilities, environmental management capabilities, resource capabilities, and organizational culture.

External Drivers—An Institutional Analysis

External drivers comprise all factors outside an organization that influence is routines and competencies (Aldrich 1999), and motivate facilities to send an environmental signal. Hoffman (1999) offers one of the most recent and comprehensive models. While his structure describes why facilities might change their environmental strategy, the framework may easily be applied to facilities' signaling decisions. There are four types of external forces exerted on facilities that prompt behavioral change: regulatory forces, resource drivers, market drivers, and social drivers.

Regulatory Drivers. Within the environmental arena, regulatory pressures are the most frequently cited external drivers for an organization's environmental action (Angell and Rands 1998; Arora and Cason 1996; Garrod and Chadwick 1996; Hart 1995; Jaffe et al. 1995; Konar and Cohen 1997; Lawrence and Morrell 1995; Porter and van der Linde 1995). These pressures are exerted on facilities at the local, county, state, national, and international levels. They come in multiple forms and include facility mandates to apply for operating permits, to adopt specific control technology, to monitor and report on its media-specific environmental activities, to allow regulator audits of their environmental activities, and to address any emissions violations and their potential legal implications. All of these actions come at a significant cost. For these reasons, facilities may send a green signal in an attempt to move beyond a compliance mode of management and thus reduce their regulatory burdens.

Firms and facilities that signal their proactive environmental management may also be able to negotiate with government officials an individualized reduction in their regulatory burden, especially in streamlining the environmental permitting process (Gallagher, Darnall, and Andrews 1999). But there might also be a strategic component to facilities' responses to these regulatory pressures in that signaling facilities may be able to influence government to impose stricter regulations and thus raise the costs of their rivals, thereby giving them competitive advantage (Darnall, Gallagher, Andrews, In Press; Salop and Scheffman 1983).[3]

Market Drivers. Market drivers are constituents, who include consumers, trade associations, and competitors that are influencing companies to consider environmentalism in their market strategies and to send green signals. Formalized networks also play an important role. For example, facilities belonging to an industry association prominently lobbying Congress and EPA are more likely to be influenced by the association's activities (Hoffman 1999). Applied to a facility's decision to send a green signal, the prominence of, for example, the Chemical Manufacturer's Association (CMA)[4] may be one reason why its Responsible Care Program received such high rates of facility participation (King and Lenox 2000).

Other pressures relate to the consumer. As information has become more readily available about a facility's environmental activities, consumers have increasingly considered

[3] The evidence is conflicting, however, as when the facilities act in anticipation of stricter regulation, particularly in the form of a uniform percentage reduction and increasing costs pollution reduction, there is an incentive for facilities to under-perform or delay their pollution abatement (Baumol and Oates 1988). Thus, facilities may not adopt voluntary environmental strategies in response to anticipation of regulation but for other regulatory-related reasons.

[4] CMA is now known as the American Chemical Council.

these factors when making their purchasing decisions (Arora and Gangopadhyay 1995; Marshall and Mayer 1991). In a 1990 public poll, 75 percent of U.S. consumers stated that they consider a company's environmental image in their shopping decisions (Kleiner 1991). Others state that they are willing to pay more for environmentally friendly products (Bhat 1993).

Resource Drivers. Resource drivers are a third type of external pressure exerted on facilities. They consist of the value chain of buyers and suppliers, insurance companies, shareholders, and investors, which affect the acquisition, processing, and distribution of resources. While a facility struggles with its own environmental issues, each of these organizations is doing the same. As a result, pressures are passed from one organization to the next, thereby normalizing environmental concerns up and down the value chain (Hoffman 1996). Related resource issues include the facility's ability to garner support from the value chain, which makes its capacity to manage its internal costs and to increase its revenues a factor particularly important to consider.

Social Drivers. Social drivers include the facility's external constituents that must be actively managed in order to develop effective and successful operating strategies (Hoffman 1999). Constituents in the social system, who include environmental groups, citizens groups and the media, can mobilize public sentiment, alter accepted norms, and change the way people think about the environment and the role of the facility in protecting it.

Social drivers have gained increasing attention since the 1980s due to the heightening influence of stakeholders on organizational strategy. Part of this changing focus may be due to increased public knowledge, albeit still limited, of organizations' environmental activities. In the past, a firm's or facility's environmental reputation received little attention, in part because of asymmetric information regarding the harmful effects of industry activity. This changed, however, with stories of environmental disasters like the nuclear accident at Three Mile Island, the Union Carbide toxic gas leak in Bhopal, and the Exxon oil spill, which have heightened public awareness and personalized the importance of facilities' environmental management. While no doubt these accidents represent an extreme, because each of these organizations was highly visible, they received additional public scrutiny for their actions (Getz 1995). These companies also have more liability exposure because they of their "deeper pockets" in which regulators and environmental groups may focus their attention (Arora and Cason 1996). For these reasons, larger facilities may have an additional incentive to reduce their liability exposure by sending green signals.

In an effort to enhance their environmental reputation, facilities may signal their greenness by participating in government-sponsored pollution prevention programs such as Green Lights and 33/50. These programs offer publicity to facilities that participate in them in the form of government sponsored press releases and highly publicized awards ceremonies. Companies, moreover, may publicize their participation in their environmental reports, in press releases, on their product labels, and through other venues.

Internal Drivers—A Resource-Based Analysis

Internal drivers are the facility-level resources and internal capabilities that affect an organization's routines and competencies (Aldrich 1999), including management strategy and facility-level resources (Hart 1995; Klassen and Whybark 1999). This resource-based approach focuses on the inter-organizational relations as the basic unit of analysis in sustained competitive advantage. The organization's main driver towards this sustainability is the use of strategic resources—assets, capabilities, and less tangible knowledge-based advantages such as socially complex organizational processes and reputational assets—that are rare, difficult to imitate, and have few substitutes (Hart 1995). There are at least four types of internal drivers that factor into a facility's environmental signaling capability: management system capabilities, environmental management capabilities, resource capabilities, and organizational culture.

Management System Capability. In general, facilities develop their business strategies in an evolutionary way to cope with both external constraints and limited information and knowledge (Hart 1995; Florida 1996). For this reason, facilities that have a commitment for continual internal improvement might also send green signals because of their capability in managing and sustaining these systems. These facilities, moreover, are more likely to accumulate the necessary resources for proactive environmental management than are facilities without such prior capability (Hart 1995; Lawrence and Morell 1995; Welford 1992), and are more competent at transferring knowledge and generating momentum to send a green signal.

Environmental Management Capability. Facility resources leading towards sustained competitive advantage are path dependent and embedded relationships between facilities' strategic environmental capabilities (Hart 1995). In order for a facility to possess the capability of sustainable development, a rare and facility-specific resource, it must first acquire the capability of pollution prevention, a tacit or causally ambiguous resource. Similarly, in order for a facility to achieve the capability of product stewardship (a higher level of environmental management), it must first be proficient in its pollution prevention activities and acquire the socially complex or process-based resources to do so. These capabilities are also a prerequisite for obtaining a capability for sustainable development—the highest level of environmental management.

Embeddedness inherently implies that the relationship is reciprocal in addition to path dependent. Indeed one could argue that increasing progress towards organizational and environmental sustainability follows a sort of "Guttman scale," with each succeeding level both incorporating and transcending the previous levels (Andrews et al. 1999). Thus, facilities that invest in sending environmental signals, at the very least, might have prior pollution prevention capabilities.

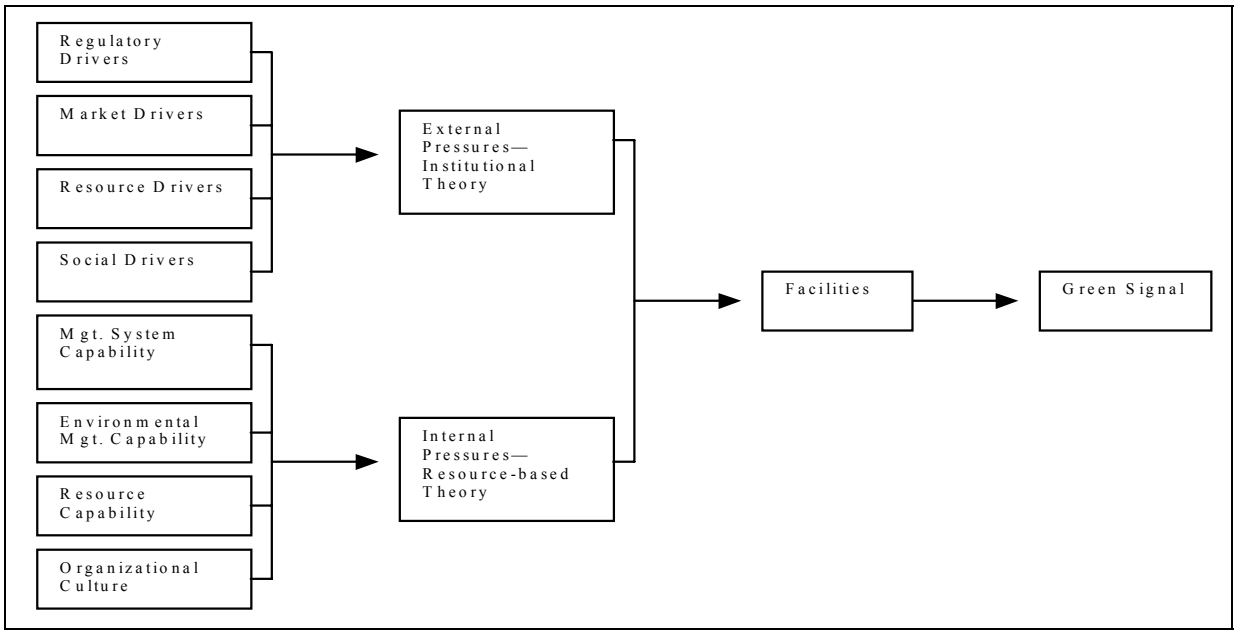
Resource Capability. A facility's decision to send a green signal requires multiple levels of employee involvement in addition to a competent staff. Facilities that are better positioned to deploy their human resources to address facility-wide management issues are also more likely to send an environmental signal in part because the costs of doing so will be

less than that for facilities that require massive staff retraining. Sending green signals, especially via EMS adoption, will demand an organization to engage its human resources to a degree that has not been required in the past. Facilities, which are thus willing and able to take on this challenge, will be better equipped to change their environmental strategies and continually improve them over time.

Organizational Culture. Organizational culture, both within the parent company and at the facility-level is also likely to influence a facility's decision to send a green signal. While it is easy to dismiss such a notion as being idealistic and having marginal influence, sending an environmental signal often requires substantial investments in capital and human resources. Simply put, should these investments fundamentally conflict with the organization's philosophy of doing business, it will be less likely to undertake such an endeavor.

Each of the external and internal drivers collectively influences a facility's decision to signal their environmental strategy, and are illustrated in Figure 1. A key question to ask for public policy research is which of these influences are most relevant and how they might be leveraged to encourage more facilities to consider signaling devices, such as EMS adoption.

Figure 1: Theoretical Model of Green Signaling



ENVIRONMENTAL SIGNALING AND EMS ADOPTION

There are many institutional vehicles that facilities may use to send environmental signals. In this study, green signaling is applied to the decision by facilities to adopt an EMS. EMS adoption is an important signaling vehicle to study for several reasons. First, EMSs have gained much attention since the internationally recognized ISO 14001 EMS standard was established in 1995. During its development many U.S. environmental regulatory agencies

became interested its potential relevance to environmental protection. This interest prompted regulators in a number of states to form the Multi-state Working Group on Environmental Management Systems (MSWG). And in 1997 the U.S. Environmental Protection Agency (EPA) agreed to support a multi-state study in cooperation with the MSWG to determine how EMSs affect the environmental and economic performance of facilities that adopt them. Today, approximately 60 pilot facilities are adopting EMSs. These facilities have agreed to provide data on their environmental and economic performance prior to and after adopting their EMS, as well as information on their EMS design processes, to the National Database on Environmental Management Systems (NDEMS).[5]

Since the pilot program began, momentum has been gaining and EPA is increasingly endorsing EMS adoption. In July 1999, the agency released a report entitled *Aiming for Excellence: Actions to Encourage Stewardship and Accelerate Environmental Progress*, and one outgrowth of it is a new cross-agency workgroup, which is developing EPA's "Performance Track" Program. The program has three goals which the agency intends to achieve in during the next three years: (1) Provide leadership in the practice of EMSs inside and outside the agency; (2) Create a fuller integration of EMSs into EPA programs and activities; (3) Promote wider adoption of EMSs across a range of organizations and settings.

Government endorsement of EMSs also extends beyond EPA and the states. In April 2000 President Clinton issued an Executive Order mandating that each Federal agency implement an EMS at "all appropriate agency facilities based on facility size, complexity, and the environmental aspects of facility operations" no later than December 2005 (EO 13148, April 22, 2000, in Andrews et al., In Press).

The MSWG, EPA, and other regulators at the state and federal levels are moving forward with EMSs as a policy option because in principle they believe that facilities which adopt EMSs may in the long run be in compliance with environmental regulations at rates greater than non-EMS adopting facilities. Moreover, government officials suggest that for facilities that adopt EMS, the environmental regulatory system may perhaps become less relevant as they continually improve their EMS and upgrade of their environmental goals and objectives. For these reasons, some government officials, in addition to firms and their facilities, see in EMSs an opportunity to make many regulations less applicable to signaling enterprises.

METHODOLOGY

To better understand the reasons why facilities send an environmental signal via EMS adoption, data from the National Database on Management Systems (NDEMS)[6] were used to

[5] All information about the database may be found on the Internet at the NDEMS homepage at http://www.eli.org/isopilots.htm. This site includes the NDEMS research protocols, the baseline database itself, periodic public reports, and other papers, as well guidance and policy documents. In the future, the EMS design database will be available at this site once the data are quality checked and the sample is of adequate size.

[6] NDEMS is joint initiative of the University of North Carolina at Chapel Hill and the Environmental Law Institute. It is supported by the U.S. Environmental Protection Agency (EPA) in cooperation with the Multi-State Working Group on Environmental Management Systems (MSWG), ten state environmental agencies, and approximately 60 businesses and other organizations that have agreed to share data with it.

test the theoretical model described above. Sixty facilities comprise NDEMS. These facilities were recruited with the assistance and coordination of USEPA, members of the MSWG, and environmental managers in ten different states, and volunteered to participate in a multi-year research project on EMS adoption and the economic and environmental benefits of it.

NDEMS data are longitudinal and are being gathered in real time. It consists of *facility-level* data, since such data are necessary to examine actual changes in environmental performance and are also the building blocks out of which any broader generalizations about corporate environmental performance must be constructed (Andrews et al., In Press).

The sample of NDEMS data evaluated here consists of 39 EMS adopting facilities. While there are additional facilities in NDEMS, the 39 facilities represent organizations that have provided complete information for the fourteen protocol questions that are the source of this analysis, see Appendix 1. Each of these questions relates to the theoretical model, as illustrated in Figure 2.

Since different types of enterprises are likely to have varying rationales for adopting an EMS, the sample was divided into three groups of facilities: publicly traded facilities (n=18), privately owned facilities (n=14), and government facilities (n=7). While the sample sizes within each group are too small to allow for an empirical estimation, they still allow meaningful descriptive comparisons between them. Moreover, because so little information is available on facility motivations for EMS adoption, this analysis provides a real contribution to our understanding of the types of pressures that most affect facilities' decisions, as well as how different types of facilities perceive these pressures.

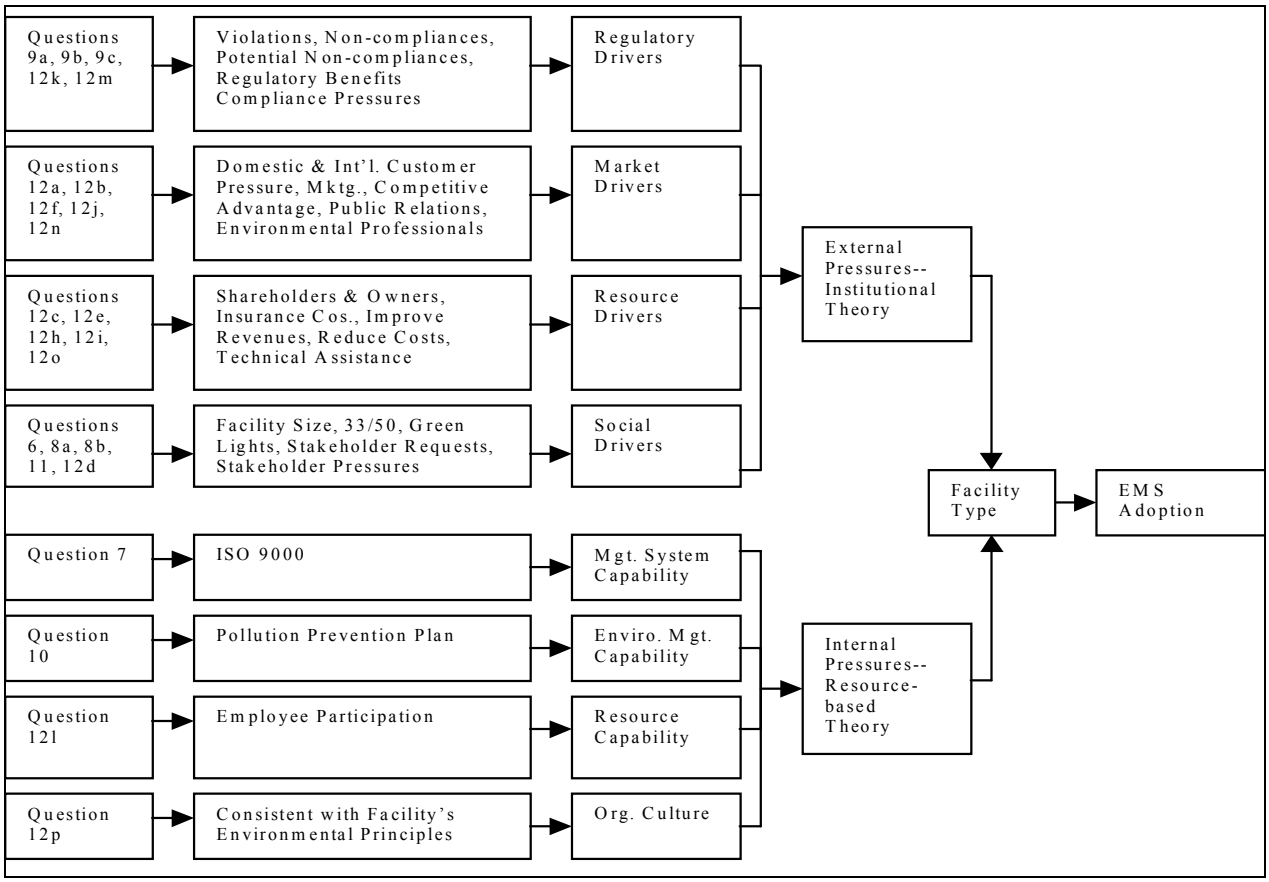
As part of grouping facility responses within each of the three facility types, it was necessary to quantify the responses using a common scale. While the NDEMS protocols were designed to address a variety of research questions related to EMS adoption, they employ multiple scales and measurements, which makes comparability across some questions a challenge.[7]

The majority of the responses follow a four-point scale. Question 14, for example, asks facilities to evaluate their rationale for EMS adoption. Responses lay on a scale of high, medium, low, and not applicable. This scale was transformed into a numerical form such that high = 4, medium = 3, low = 2, and not applicable = 1, which could then be summed and averaged within each of the three groups to allow inter-group comparisons.

Questions 10, 11, and 12 elicited discrete responses. In order to make these responses comparable to a four-point scale; the discrete choices were scaled equal to four if the discrete choice was made; one otherwise. Similarly, question 13 was rescaled. It elicited a response to one of five options. To make these data comparable to a four-point scale, the first two choices were collapsed into one category.

[7] There are various reasons why the questions have different scales that relate to the difficult task of anticipating how each question might be used in research, as well as the multi-level political process which shaped the NDEMS protocol development. As a result, for the twelve questions relevant for this analysis, a common scale was developed.

Figure 2: Estimation Model of Facilities' Rationales for Sending Green Signals



RESULTS

Once scaling was completed, responses for the three types of facilities were summed and then averaged for each type of external and internal pressure of interest, then two types of analyses were performed. First, a descriptive analysis was performed to better understand the nature of facilities that adopt an EMS and ISO 14001 certified EMSs. Second, the model for facilities' rationales for EMS adoption was evaluated by creating indices for each of the external and internal pressures discussed above. These indices define the magnitude of each driver for EMS adoption and allow for comparisons across all three types of EMS adopters.

The descriptive statistics show that the publicly traded and privately owned enterprises largely consist of manufacturing facilities, as seen in Table 1. Two traded facilities have power distribution operations. Of the government facilities included in the study, four are local governments. The others consist of a national level government facility, a university, and a redevelopment agency.

When comparing facility sizes, the publicly traded facility group differs from the privately owned and government groups in it is comprised mainly of medium-large and larger-

sized organizations (72 percent) and only a few of small facilities (11 percent), see Table 2. The privately owned and government facility groups are more diverse, however, in that they are comprised of relatively equal sizes of small, medium, and large facilities, although there are fewer large facilities.

Table 1: Industry Association

Facility Type	**Industrial Type**	
• Traded Facilities (18)	14 = manufacturing 2 = power distribution	1 = foods 1 = resource production
• Privately Owned Facilities (14)	13 = manufacturing	1 = lab equipment
• Government Facilities (7)	4 = local government 1 = national government	1 = university 1 = redevelopment agency

Table 2: Facility Sizes

Facility Type	**Number of Employees**			
	< 100	100 to 299	300 to 999	> 1000
• Traded Facilities (18)	11% (2)	17% (3)	50% (9)	22% (4)
• Privately Owned Facilities (14)	29% (4)	29% (4)	36% (5)	7% (1)
• Government Facilities (7)	57% (4)	0% (0)	29% (2)	14% (1)

All of the publicly traded companies are marketing their products internationally and 89 percent of them are producing their goods in international markets, as seen in Table 3. This contrasts the privately owned companies, which are more subdued in the production and marketing of their products in international arenas. Seventy percent (10) of the privately owned companies are marketing their products internationally and 30 percent (4) are involved in international production. As might be expected, the government facilities are much less involved in the international arenas.

Table 3: International Production and Marketing

Facility Type	**International Production**	**International Marketing of Products**
• Traded Facilities (18)	89%	100%
• Privately Owned Facilities (14)	36%	71%
• Government Facilities (7)	0%	26%

Of the 39 facilities, four-fifths (80 percent) belong to a larger organization or parent company and of these facilities, *all* of the publicly traded enterprises belong to larger organizations, as described in Table 4. In contrast, 64 percent of privately owned facilities and

over half (57 percent) of the government facilities have parent companies. These findings provide some insight on facilities' internal capabilities, as one might expect that organizations belonging to parent companies might have greater access to resources that support the EMS adoption process.

For privately owned and government facilities with parent organizations, ISO 14001 certification rates are similar, as 50 percent of both groups have adopted or intend to adopt ISO 14001. This differs from publicly traded facilities, for which 78 percent either have already adopted or intend to adopt ISO 14001.

Table 4: Relationship with Larger Organizations and ISO 14001

Facility Type	**Single Plant Ownership & Certification Status***		**Facility with Parent Company & Certification Status***			**Total ISO Certified***
	Single Plant	*Single Plant w/ ISO 14001*	*Facility w / Parent Co.*	*Facility w/ Parent Co. & ISO 14001*	*Parent Co. Requires or Encourages EMS Adoption*	**Facilities**
• Traded	0% (0)	N/A	100% (18)	78% (14)	89% (16)	72% (13)
• Privately Owned	36% (5)	38% (3)	64% (9)	50% (5)	43% (6)	71% (10)
• Government	43% (3)	33% (1)	57% (4)	50% (2)	0% (0)	43% (3)
Facility Total	***18% (7)***	***10% (4)***	***80% (31)***	***56% (22)***	***56% (22)***	***67% (26)***

***** Denotes those facilities which are presently certified to ISO 14001 or are seeking third party certification to ISO 14001. Facilities which forego third party certification are not included in these counts.

For publicly traded facilities, 89 percent were required or encouraged by their parent company to adopt an EMS. Privately owned companies, however, have a far less degree of parent company involvement in their EMS adoption, as less than half (43 percent) of them are required or encouraged by their parent company to adopt an EMS. Interestingly, none of the parent companies of government facilities have mandated or even encouraged EMS adoption. Instead, these larger organizations have remained neutral in the facility-level decisions related to this matter. Thus, EMS adoption largely occurs under the leadership of the facility managers themselves.

Finally, facilities that can be described as "single plants" with no parent company have ISO 14001 certification rates less than those organizations with parent companies. ISO 14001 certification for single plant private companies is 38 percent, as compared to 78 percent of

privately owned companies with parent companies. This information points to the importance of parent companies' influences on facility-level ISO 14001 certification decisions.

The results of the estimation of theoretical model of facilities' rationales for EMS adoption are illustrated in Table 5. The table describes the estimated indices for each of the external and internal drivers as well as the various pressures that comprise the indices themselves.

External Drivers

Regulatory Drivers. Of all the external drivers, regulatory pressures had the greatest influence on facilities' decisions to adopt an EMS, as noted by the *regulatory driver index* (2.60). This finding speaks to the importance of the environmental regulatory system on facilities' decisions to adopt an EMS, and is congruent with previous research on the voluntary environmental activities of enterprise. Interestingly, regulatory drivers exerted similar degrees of influence on EMS adoption decisions for all three types of facilities, although these pressures influenced privately owned facilities to a greater degree.

Table 5: Statistical Analysis Results

Drivers	**Facility Type**		
	Publicly Traded	***Privately Owned***	***Government***
EXTERNAL DRIVERS:			
Regulatory Drivers			
1. No. Violations (9a)	2.30	2.0	1.9
2. No. Non-Compliances (9b)	2.40	1.68	2.71
3. No. Potential Non-Compliances (9c)	2.20	1.62	3.10
4. Regulatory Benefits (12k)	3.17	3.71	3.29
5. Improve Compliance (12m)	2.94	2.86	3.14
Regulatory Driver Index	*2.60*	*2.37*	*2.83*
Market Drivers			
1. Domestic Customer Pressures (12a)	2.33	1.71	1.00
2. International Customer Pressures (12b)	2.28	1.71	1.00
3. Valuable Marketing Tool (12f)	2.82	2.64	1.29
4. Valuable Public Relations Tool (12g)	2.56	2.93	2.67
5. Improve Competitive Advantage (12j)	3.06	3.00	1.71
6. Enviro. Professionals Support EMSs (12n)	2.25	2.0	2.00
Market Driver Index	*2.55*	*2.33*	*1.61*
Resource Drivers			

1. Insurance Company Pressures (12c)	2.06	1.71	1.00
2. Shareholders & Owners Pressure (12e)	1.50	1.71	1.29
3. Availability of Technical Assistance (12o)	1.78	2.79	2.86
4. Reduce Costs (12i)	2.71	2.43	1.29
5. Increase Revenues (12l)	3.43	3.14	3.14
Resource Driver Index	*2.30*	*2.36*	*1.92*
Social Drivers			
1. Facility Size (6)	2.83	2.00	2.00
2. 33/50 Participation (8a)	2.17	1.86	1.00
3. Green Lights Participation (8b)	1.83	1.21	1.00
4. No. of Stakeholder Requests (11)	2.50	2.29	2.29
5. Stakeholder Pressures (12d)	1.47	1.14	1.29
Social Driver Index	*2.16*	*1.70*	*1.52*
EXTERNAL DRIVER INDEX	***2.41***	***2.20***	***1.95***
INTERNAL DRIVERS			
Management System Capability			
1. ISO 9000 (7)	3.17	3.57	1.00
Environmental Management Capability			
1. Pollution Prevention Plan (10)	2.83	2.29	1.43
Resource Capability			
1. Improve Employee Participation (12h)	3.17	3.21	2.71
Organizational Culture			
1. Consistent w/Facility's Env. Principles (12p)	3.67	3.64	3.57
INTERNAL DRIVER INDEX	***3.21***	***3.28***	***2.18***

The specific influence of *regulatory benefits* on facilities' EMS adoption decisions is the single most important *regulatory driver* for all three facilities. Moreover, both privately owned and government facilities report that of the all the *external drivers*, regulatory benefits are the single most important influence (3.71, 3.29, respectively) on their EMS adoption decisions. For publicly traded facilities, these benefits are the second most important external driver (3.17). These findings may be particularly meaningful for public policy and the role of government in encouraging future EMS adoption.

Market Drivers. The *market driver index* yielded the greatest variance among the three types of facilities than any other external driver category. As might be expected, market drivers are more relevant to publicly traded facilities (2.55) and to a lesser degree privately owned facilities (2.33). Government facilities, however, report that market pressures had only a marginal impact (1.61) on their EMS adoption decisions. These findings are consistent with

the international production and marketing figures described in Table 3, which indicate low activities by government facilities in these arenas.

Of the various market drivers, *customer pressures* from both domestic and international buyers were more relevant to publicly traded facilities' EMS adoption decisions than they were to privately owned facilities' decisions. In addition, publicly traded and privately owned facilities believed that EMS adoption might provide them a competitive advantage, and thus was a strong influence on their decision to adopt an EMS (3.06 and 3.00, respectively). These facilities also thought about how they might leverage EMS adoption as a marketing tool, and all three types of facilities thought that EMS adoption might benefit their public relations.

Resource Drivers. Perhaps the most important finding related to the various resource driver influences is the prominent role that government assistance programs played for privately owned companies (2.79) and government programs (2.86). These programs offered aid to facilities during their EMS development and implementation, and had an important impact on facility decisions to adopt an EMS.

Publicly traded and privately owned facilities reported that resource drivers such as the potential to reduce costs (2.17 and 2.43, respectively) and increase revenues (3.43 and 3.14, respectively) were also relevant to their EMS adoption decisions. Interestingly, shareholders and owners have little influence (1.50 and 1.71, respectively). Taken together, these results may indicate that facility managers are considering an EMS as a tool to increase production efficiency.

Social Drivers. Social drivers are the least influential external drivers on facilities' EMS adoption decisions. This finding is interesting because while all three types of facilities report a moderate number of stakeholder requests, they also suggest that social pressures are only a marginal component of their EMS adoption decisions. This finding may be due in part to the relative nature of the stakeholder requests themselves, as they are likely to be non-threatening inquiries, otherwise they would likely have had a greater influence on facilities' EMS adoption decisions.

Internal Drivers

Overall, internal drivers had a greater impact on facility's decisions to adopt an EMS than did external drivers, as seen when comparing the *internal driver indices* (3.21, 3.28, 2.18) to the *external driver indices* (2.41, 2.20, 1.95) for each of the three types of facilities. These differences point to the importance of facilities' internal capabilities in their EMS adoption decisions.

Management System Capability. In evaluating facilities' management system capabilities prior to EMS adoption both publicly traded (3.17) and privately owned facilities largely (3.57) made their EMS adoption decisions with ISO 9000 management system capabilities in place. Because of this preexisting capability, EMS adoption and maintenance likely demand fewer internal resources and was more easily integrated into the facility's

management practices themselves. This is a stark contrast to government facilities, of which none had in place an ISO 9000 management system prior to EMS adoption.

Environmental Management Capability. With respect to facilities' prior environmental management (EM), most publicly traded facilities had EM capabilities (2.85) during the three years prior to EMS adoption. Privately owned and government facilities, however, had lagging capabilities (2.29 and 1.43, respectively). Despite the lack of capabilities prior to EMS adoption, private and government facilities still pursued EMS adoption, which is surprising—especially for government facilities whose capabilities were minimal. One explanation for these results is that shortcomings in government facilities' management system and EM capabilities might have been offset by the technical assistance benefits which they received, as interestingly these benefits played a significant role in their EMS adoption decisions. The same is true for privately owned facilities. In contrast, publicly traded facilities, which largely had strong internal capabilities prior to EMS adoption, were influenced only marginally by the technical assistance programs that were offered to them. In fact of the external drivers, technical assistance programs had one of the lowest rated influences on publicly traded facilities' EMS adoption decisions.

Resource Capability. Both publicly traded and privately owned facilities hoped that EMS adoption might improve their employees' participation in their environmental management activities (3.17 and 3.21, respectively). Government facilities, however, were less influenced (2.71) by the possibility of improving employee involvement. Two issues come to mind when evaluating these differences. First, government facilities may have already involved their employees in their environmental management, and thus believe that they need not be involved to greater degrees. This notion, however, is dismissed as prior to EMS adoption only one of the seven government facilities had in place pollution prevention plan and none had prior capabilities in ISO 9000, both of which emphasize employee involvement in management in facility operations. This leads one to conclude that participation by employees in environmental management is not beyond improvement. The second and more likely possibility is that government facilities, when making their EMS adoption decisions, did not fully recognize the how EMSs might influence their human resource capabilities. What will be interesting to determine is whether employee involvement changes after EMS adoption, especially for government facilities, as they have potentially the greatest potential gains to make in this area.

Organizational Culture. All three facility groups report that their organizational cultures affected their decision to adopt an EMS. Indeed, for each facility group it is the most powerful internal driver (3.67, 3.64, and 3.57). While it is easy to dismiss these findings as idealistic and largely based on the perception of the facility's environmental manager who completed the survey, adopting an EMS generally requires substantial investments in capital and human resources. Should these investments fundamentally conflict the organization's philosophy of doing business, the facility will be less likely to undertake such an endeavor. For all three facility groups, organizational culture played an influential role in EMS adoption.

CONCLUDING REMARKS

The increasing rate of EMS adoption is an important environmental signaling phenomenon in itself, and for the businesses that choose to implement them. Among the many recent initiatives toward "voluntary approaches" to improve environmental management, the adoption of EMSs represents the most significant form to date of a systematic commitment to continuous environmental improvement by facilities and their parent organizations, which also gives it greater legitimacy as a green signal. This research begins to understand the phenomenon of environmental signaling by presenting a theoretical model and performing an exploratory analysis to explain EMS adoption decisions.

The results of this analysis emphasize the importance of the U.S. environmental regulatory system as a motivator for EMS adoption for all three types of facilities. These findings give further evidence to the suggestion that the presence of the regulatory system itself may foster facilities' decisions to consider environmental management goals as part of their profit maximizing criteria. More specifically, it appears that facilities are adopting EMSs to ease the regulations imposed on them. In doing so, they are "signaling" their likelihood for exemplary environmental compliance, and thus reducing their regulatory burdens via negotiated regulatory benefits. This finding is particularly relevant to regulators in that EMS adoption at the facility level might be encouraged in *all* types of organizations by extending regulatory benefits to them.

Second, publicly traded facilities appear to have strong internal capabilities that fortify their EMS adoption decisions. For privately owned and government facilities, these capabilities are less impressive, which may create a barrier in their decision to adopt an EMS. Internal capabilities, however, inherently interact with external resources. Where a capability might be lacking, an external resource might be leveraged to strengthen it. With respect to a facility's decision to adopt an EMS, the availability of technical assistance (e.g. EMS design and implementation training, small grants, and periodic meetings with other facilities to learn about each other's EMS implementation successes and failures) may be particularly relevant to strengthening these capabilities so that EMS adoption is possible for privately owned and government facilities that would otherwise not consider it. Technical assistance, moreover, may be particularly important for federal facilities that are subject to Executive Order 13148, as their internal capabilities might not be able to support and maintain a viable EMS.

Technical assistance, at least in the form stated above, may be less effective at encouraging EMS adoption for publicly traded facilities, however. One reason for this is publicly traded facilities have prior internal resources and capabilities that are more likely to support EMS adoption, and thus technical assistance is not needed. All of these facilities, moreover, belong to parent companies, which increases their access to additional resources. Publicly traded facilities, however, do appear to respond to incentives related to potential regulatory benefits. While these benefits have yet to be realized, pilot facilities anticipate them to come in the form of expedited and consolidated permitting. Some states are considering the possibility of waiving state regulations, and seeking waivers of federal regulations, for facilities that achieve environmental results that are superior to those otherwise required by

law. All three types of pilot facilities have responded to these potential regulatory benefits, which appear to be strong reasons for their decision to adopt an EMS.

Two topics merit exploration in future research. First, while EMS adoption occurs at the facility level, many facilities' decisions about their environmental management strategy are made at the corporate-level. Evidence of this corporate level influence is seen in the descriptive statistics above—72 percent of the publicly traded facilities have adopted their EMSs because of corporate mandate. Thus, a key question for future research to address is what factors influence parent companies to mandate or encourage EMS adoption in their facilities and how they might differ from facility-level adoption decisions.

Second, these results are for facilities that participated in a pilot program. What is important to know is how these facilities and their parent companies differ from facilities that do not adopt an EMS and facilities that adopt an EMS but do not participate in a pilot program. It is likely that the pilot facilities, because states imposed compliance criteria on their participation, have compliance records that are better-than-average. In order to achieve these better-than-average compliance records, resource-based theory that these facilities and their parent companies have *greater* internal capacities than other enterprises. If this suggestion is correct, then technical assistance may be even *more* relevant to encourage EMS adoption among the broader population of U.S. facilities.

There is still much that can be learned about facilities' EMS adoption decisions, and the voluntary environmental management activities that lead to green signals. The information presented here provides a theoretical framework for exploring these decisions and offers some preliminary evidence about those types of factors that may play a greater role than others.

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APPENDIX 1:
Relevant Subset of NDEMS Questions[8]

1. What is your facility's primary business or function? _____ (see attached organization type code list)

   If your facility's primary business function is I1 (other), please specify what that function is: _____

2. Is your facility part of a larger business or government organization?

   ___ no

   ___ yes (please describe your relationship with this larger organization:_____)

3. Is your facility or parent organization (please check one):

   ___ publicly traded

   ___ privately owned

   ___ government (municipality or federal facility)

4. Does your organization produce any products in countries other than the United States?

   ___ yes (please list the countries: _____)

   ___ no

5. Does your organization market its products in countries other than the United States?

   ___ yes (please list the countries: _____)

   ___ no

[8] The complete NDEMS protocols are available at www.eli.org/isopilots.htm.

6. How many full-time employees work at your facility?

___ < 20 ___ 100 - 299
___ 20 - 49 ___ 300 - 999
___ 50 - 99 ___ > 1,000

7. Corporate-Facility EMS Relationship—If your facility is part of a larger organization, how did that organization affect your facility's decision to adopt an EMS? Choose one:

Note: a larger organization is the corporate or parent enterprise, if such an enterprise exists, with which a facility is affiliated.

___ N/A This facility is not part of a larger organization (Please proceed to the next question)
___ The larger organization *requires* (or will require) all its facilities to adopt an EMS.
___ The larger organization *encourages* all its facilities to adopt an EMS.
___ The larger organization is *neutral* (neither encourages nor discourages) its facilities to adopt an EMS.
___ The larger organization *discourages* its facilities to adopt an EMS.

8. ISO 14001 Certification—Check **all** the categories that describe your facility's certification status:

___My facility is ISO 14001-certified
___My facility is ISO 14001-**self-certified**
___My facility intends to become ISO 14001-certified
___My facility intends to become ISO 14001-**self-certified**
___My facility **does not** intend to become either ISO 14001-certified, or self-certified

9. Did your facility have ISO 9000 certification prior to adopting its EMS?

___ yes
___ no

10. Which of the following voluntary environmental management did your facility participate in prior to adopting its EMS? (Check all that apply)

__ a. EPA's 33/50 Program
__ b. Green Lights

11. Violations, Non-compliances, and Potential Non-compliances—Please use the following definitions when answering (11.a) through (11.c), below:

Violation: non-compliance discovered by environmental agency personnel or reported to agency personnel which results in a formal enforcement action against the facility.
Non-compliance: non-conformity in fulfilling legal requirements.

a. Over the past three years, has your facility had any violations?

___ yes
___ no

b. Over the past three years, has your facility had any reported non-compliances?

___ yes
___ no

c. Over the past three years, has your facility had any potential non-compliances (i.e. a which your facility would likely have been out of compliance, but discovered and corrected the situation before non-compliance occurred)?

___ yes
___ no

12. During the three years prior to EMS adoption, did your facility engage in pollution prevention activities?

__ yes
__ no

13. Over the past three years, how often has your facility, on average, responded to inquiries from outside parties regarding the environmental characteristics of your products or services or the environmental performance of your facility?

___ 0 or 1 time per year
___ 2 to 10 times per year
___ 11 to 50 times per year
___ 50 to 100 times per year
___ 100 or more times per year

14. Rationale for Adopting an EMS—Facilities adopt EMSs for a variety of reasons. From the list of options below, please circle the appropriate letter (H= high importance; M= medium importance; L= low importance; N/A= not applicable) *to rank each* of the following items in terms of how important they were to your facility's decision to adopt an EMS.

a	H	M	L	N/A	Domestic customers' pressure for ISO 14001 certification
b	H	M	L	N/A	International customers' pressure ISO 14001 for certification
c	H	M	L	N/A	Shareholders' or owners' pressure for ISO 14001 certification
d	H	M	L	N/A	Outside interested parties' pressure to adopt an EMS
e	H	M	L	N/A	Insurers may reward ISO 14001 certification
f	H	M	L	N/A	EMS adoption may be a valuable marketing tool
g	H	M	L	N/A	EMS adoption may be a valuable public relations tool
h	H	M	L	N/A	Adoption of an EMS may reduce our costs
i	H	M	L	N/A	Adoption of an EMS may increase our revenues

j H M L N/A Adoption of an EMS may provide a competitive advantage

k H M L N/A Adoption of an EMS may lead to regulatory benefits

l H M L N/A Adoption of an EMS may improve our employees' participation in the facility's environmental performance

m H M L N/A Adoption of an EMS may improve facility compliance with environmental regulations

n H M L N/A Environmental management professionals are increasingly supporting EMSs

o H M L N/A Availability of government assistance programs to aid in EMS development makes EMS adoption attractive

p H M L N/A Adoption of an EMS is consistent with the facility's overall environmental principles

q H M L N/A Other (please specify: _____)

r H M L N/A Other (please specify: _____)