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PREDICTING THE COST OF ENVIRONMENTAL MANAGEMENT SYSTEM ADOPTION: THE ROLE OF CAPABILITIES, RESOURCES AND OWNERSHIP STRUCTURE

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This research explores why some facilities accrue greater costs when adopting an environmental management system (EMS) and why costs vary among three different ownership structures. Using survey data of organizations that documented their EMS adoption costs over a 3-year period, the results show that publicly traded facilities had stronger complementary capabilities prior to EMS adoption and therefore lower adoption costs. By contrast, government facilities and privately owned enterprises had fewer capabilities and accrued higher EMS adoption costs. The development of organizational capabilities and resources therefore appears to be a function of both organizational exploitation of imperfect or incomplete market factors, and the institutional context of these decisions. Copyright © 2006 John Wiley & Sons, Ltd.

INTRODUCTION

Since 1996, when the International Organization for Standardization (ISO) designed its environmental management system (EMS) standard, ISO 14001, EMSs have gained increasing attention. Enterprises that adopt an EMS systematically consider their impact to the natural environment by developing an environmental policy, evaluating their internal processes that affect the environment, creating objectives and targets, monitoring progress and obtaining management review. In the United States alone, more than 3553 facilities had certified their EMSs to ISO 14001 by 2003 (ISO, 2004), and many more had adopted non-certified EMSs.

Despite the increasing pace of EMS adoption, little is known about adoption costs. Understanding the variations in EMS adoption expenditures is important for several reasons. First, many management scholars have inferred that a relationship exists between an organization's environmental strategy and its internal capabilities in that basic competencies must be in place before organizations can develop advanced environmental management practices requiring higher-ordered learning proficiencies (Hart, 1995; Christmann, 2000).

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In the absence of these basic capabilities, adopting advanced environmental practices will be more costly. While these relationships largely have been assumed, as yet they have not been tested empirically, and studying them will help to explain why some organizations adopt advanced environmental strategies while others do not.

Second, institutional theory suggests that organizations having the same ownership structures are expected to develop similar complementary resources and capabilities that facilitate EMS adoption. While prior research has pointed to the importance of ownership structures (Mascarenhas, 1989), most studies in this area evaluate one or two ownership structures (Meyer, 1982) and ignore the government enterprise. Other research has suggested that ownership differences exist as they relate to enterprise domain (Mascarenhas, 1989), but little is known about the effect of ownership structure on environmental strategy. By studying this institutional setting we may discover important reasons for why different organizations carry out specific activities (Mascarenhas, 1989), especially when we simultaneously consider their organization-specific competencies. In the process we may realize that organizational capabilities and resources are a function of both organizations exploiting imperfect or incomplete market factors, as suggested by the resource-based view of the firm (RBV), and the institutional context of these decisions.

Third, managers of many organizations are faced with making a strategic decision about whether or not to adopt an EMS. By understanding the factors that predict the cost of EMS adoption, decision-makers may be able to assess their organization's anticipated adoption cost and therefore build internal support for or against it. Finally, an appreciation of ownership differences can also help regulators, who are trying to encourage additional organizations to adopt EMSs through various incentive-based programs. These programs offer enterprises subsidies in the form of grants and technical assistance without recognizing that different types of organizations might vary in their ability to adopt an EMS and that these subsidies might not mitigate EMS adoption costs sufficiently.

This study investigates whether organizations with stronger complementary capabilities and greater access to resources incur fewer EMS adoption costs. It discusses whether EMS adoption costs vary by ownership structure and whether these variations relate to their ability to develop complementary capabilities and gain access to resources. Using propositions articulated by the resource-based view of the firm (RBV) and institutional theory, organizations' internal capabilities were evaluated for three ownership structures—publicly traded and privately owned organizations and government operations. These relationships were then tested empirically using EMS adoption cost data for facilities that tracked their expenditures over a 3-year period. The results support RBV tenets in that organizations' prior internal competencies predicted their EMS adoption costs. They similarly support prior institutional theory in that aggregate ownership structure was related to EMS adoption costs. Together, both theoretical views provide a more comprehensive perspective regarding the cost of adopting an environmental strategy.

DEFINING AN EMS

Unlike government regulation, which imposes requirements on organizations from the outside, an EMS consists of a regulatory structure that arises from within an organization (Coglianese and Nash, 2001). An EMS is a collection of internal efforts at policy making, assessment, planning, and implementation (Ortz, 1995; Coglianese and Nash, 2001). Based on Deming's (1986) continuous improvement model, EMSs are systems of management processes that enable organizations to continually reduce their impact to the natural environment. EMSs consist of an environmental policy, as well as a set of evaluation processes that require organizations to assess their environmental impacts, establish goals, implement environmental goals, monitor goal attainment, and undergo management review (Lamprecht, 1997).

The first step in EMS adoption is securing an organization-wide pledge for responsible environmental management. This pledge (or environmental policy) is made public and states the organization's general philosophy for environmental improvement. Environmental pledges often incorporate commitments for continual improvement, for pollution prevention, and for complying with relevant environmental legislation (Starkey, 1998). The second EMS adoption step is evaluation and goal setting. During this stage, the organization determines how to translate its environmental policy into action and sets management priorities (objectives and targets) (Netherwood, 1998).

During the third stage of an EMS adoption, an organization creates a management structure to realize its environmental goals. In doing so, the enterprise trains employees, enhances communications structures both within and outside the organization, and reduces its significant environmental impacts. Because an EMS is a tool to improve an organization's environmental management, the fourth component, monitoring and corrective action, is important for continuous environmental improvement. Organizations monitor for discrepancies within the system by recording and documenting the routine operation of the EMS and by periodically auditing their activities. When discrepancies are identified, the enterprise corrects them so that continual environmental improvement remains on course (Netherwood, 1998).

The final stage that is common to all types of EMSs is management review. Generally, management reviews involve critical assessments of internal audits, progress reports, non-compliance actions, new environmental concerns and recommendations to amend the EMS (Netherwood, 1998). After considering this information, the organization develops (and periodically updates) an EMS status report. This report identifies the EMS's shortcomings, highlights any need for tighter controls, amends environmental objectives and targets, and sets new goals (Welford, 1998).

Despite the fact that all EMSs are common in their adoption stages, they still vary in their ability to mitigate environmental impacts and to integrate environmental management into the organization (Netherwood, 1998). To minimize this variation and to provide greater guidance during the EMS adoption process, ISO created its international EMS standard, ISO 14001 (Netherwood, 1998). By adopting an ISO 14001 EMS, an organization is able to establish external legitimacy for its EMS (Bansal and Hunter, 2003), because the standard gives specific guidance at each EMS adoption stage, and requires that an external third-party registrar verify that the EMS conforms to the ISO 14001 standard (Starkey, 1998). By contrast, organizations that adopt non-certified EMSs have more flexibility in the degree to which environmental management is integrated throughout the organization, and avoid certification costs as part of their EMS adoption process.

Costs are accrued during each of the EMS adoption stages, including certification (if applicable); however, the first three stages are the most resource intensive. More resources are required at the early stages of EMS design because organizations have to undertake extensive internal evaluations, employee training, and plan development (Stapelton, Glover and Davis, 2001). Consultants also may be hired during the early stages of EMS adoption in order to help assess the facility's environmental impacts and develop implementation plans. Training costs relate to employee travel to EMS development workshops. Additionally, some organizations might purchase equipment and materials to facilitate EMS adoption, although these costs are expected to be minimal during EMS adoption and more relevant during the continual improvement process (Stapelton *et al.*, 2001).

EMSs AS VALUE ADDING CAPABILITIES

At the most basic level an EMS can help organizations assure that their management practices conform to environmental regulations. However, the EMS structure also encourages facilities to prevent pollution by substituting unregulated for regulated inputs and by eliminating some regulated processes altogether. As a result, some enterprises may no longer be subject to some costly regulatory mandates. Further, EMSs assist enterprises to scrutinize their internal operations, engage employees in environmental issues, continually monitor their progress, and increase their knowledge about their operations. All of these actions also can help organizations improve their internal operations, achieve greater efficiencies, and create opportunities for improving their strategic value, because at a basic level they depend upon intensive employee involvement (Lawler, 1986; Hart, 1995; Cole, 1991) and team production (Makower, 1993; Willig, 1994). Moreover, each of these activities relies on knowledge-based skills that are decentralized and difficult for competitors to replicate, thereby creating opportunities to gain competitive advantage (Hart, 1995).

In other instances, EMSs have the potential to encourage organizations to adopt more sophisticated environmental strategies that build on their basic pollution prevention principles. For example, as part of their EMS, some enterprises may implement life cycle cost analysis and assess their activities at each step of their value chain—from raw materials access to disposition of used products (Allenby, 1991; Fiksel, 1993). These more advanced environmental strategies leverage basic pollution prevention principles, but also extend them by integrating external stakeholders into product design and development processes (Allenby, 1991). By using these advanced strategies, organizations can eliminate environmentally hazardous production processes, redesign existing product systems to reduce life cycle impacts, and develop new products with lower life cycle costs (Hart, 1995). Such actions represent a significant departure from basic pollution prevention principles because they offer a vehicle for organizations to assess all aspects of their operations jointly, thus minimizing the shift of environmental harms from one subsystem to another (Shrivastava, 1995). In the process, EMSs can assist the whole organization in achieving greater organizational efficiency (Welford, 1992).

However, some organizations may achieve these efficiencies with fewer resources because they possess complementary competencies prior to EMS adoption. As a result, these organizations may enjoy greater opportunities for competitive advantage through continual environmental and organizational improvement.

COMPLEMENTARY CAPABILITIES FOR EMS ADOPTION

The intangible and knowledge-based processes necessary for EMS adoption may be acquired with fewer resources if complementary capabilities already exist. A capability is considered complementary to EMS adoption if it facilitates the implementation process. For example, an organization's embedded expertise with complementary knowledge-based processes, such as quality-based and inventory control management systems, may assist the development of more advanced environmental management processes (Hart, 1995). Both management systems facilitate organization-wide changes and encourage an organization to persistently improve its internal operations around a common goal (Falk, 2002). Quality-based management systems require an organization-wide commitment to continually improve the organization's process and product quality. The success of these systems requires extensive knowledge and monitoring of organizational resources, constraints, production capabilities, and processes (ISO, 2001). Like EMS adopters, organizations that adopt quality-based management systems plan strategically for the long term and develop a capacity to assess their progress toward achieving desired outcomes (Kitazawa and Sarkis 2000).

Similarly, organizations that have expertise with inventory control management systems also have developed their knowledge-based competencies. Rather than focusing on product and process quality, these systems require organizations to reduce redundant stock materials and unnecessary inputs in the production process (Rosenberg and Campbell, 1985). Organizations that rely on inventory control systems manage materials, productive capacity, and other organizational information (Rosenberg and Campbell, 1985). The skills required to adopt inventory control management systems are complementary to the capabilities required for the successful adoption of EMSs because both systems encourage enterprises to rely on lean production practices that promote reductions in input use, which are important for minimizing impacts to the natural environment. Organizations that adopt these systems, or quality-based management systems, also have developed a culture that embraces continuous internal evaluations that help push the organization toward achieving greater organizational efficiency (Lawrence and Morell, 1995; Welford, 1992)—both within and across operational units—which is critical for environmental improvement (Netherwood, 1998). These competencies are also expected to facilitate EMS adoption and provide a means for organizations to reduce their EMS adoption costs.

Hypothesis 1: Organizations with quality-based and inventory control management systems experience incur fewer EMS adoption costs.

In addition to expertise with quality-based and inventory control management systems, prior experience with pollution prevention practices is expected to reduce the resources required for EMS adoption. An organization that has experience with pollution prevention reduces the waste it generates in the production process prior to recycling, treatment, or disposal (USEPA, 2001a). Implementing pollution prevention practices require many employees to work together and share their tacit knowledge of the organization's internal operations in order to minimize impact to the natural environment (Hart, 1995). Organizations that implement pollution prevention practices also have invested in training their employees and therefore can apply their skills toward more advanced forms of environmental management (Kunes, 2001; Hart, 1995). Such notions suggest that an organization's environmental management capabilities may be path dependent in that internal proficiencies and learning accrue over a period of time. To attain a higher level of environmental competency (such as EMS adoption) organizations may first need to be expert in basic levels of environmental competency, and acquire the socially complex or process-based resources to do so (Christmann, 2000; Henriques and Sadorsky, 1996; Hart, 1995; Russo and Fouts, 1997). Similarly, enterprises that have basic pollution prevention practices may reduce their EMS adoption costs because they already have a foundation for proactive environmental strategies that can be extended to support the organization-wide commitments required to adopt an EMS.

Even in organizations that already rely extensively on pollution prevention, EMS adoption can have important behavioral and managerial impacts that improve internal efficiencies (Rondinelli and Vastag, 2000). These additional benefits occur because EMSs generally involve more rigorous internal assessments than pollution prevention practices in that they create formal structures to implement corrective actions when problems arise (USDOE, 1998). Further, EMSs make a greater attempt to formalize managerial commitment (Rondinelli and Vastag, 2000), community involvement, and external auditing (Coglianese and Nash, 2001) than seen in typical pollution prevention efforts. As a result, while many organizations already employ pollution prevention principles, and have a culture of waste minimization, adopting an EMS may encourage them to take a more systematic approach to building source reduction into all products and processes from their onset, thus institutionalizing existing pollution prevention programs and extending them throughout the organization (USDOE, 1998). For these reasons, an organization's pollution prevention practices serve as a foundation that facilitates EMS adoption and are anticipated to reduce adoption costs.

Hypothesis 2: Organizations with pollution prevention practices incur fewer EMS adoption costs.

An organization's environmental strategy depends on its ability to distribute resources toward developing basic strategic competencies (Aragon-Correa, 1998; Russo and Fouts, 1997). Organizations that operate efficiently allocate their resources toward achieving increased operational effectiveness by sharing financial resources (Bowen, 2002) and increasing environmental expertise between the parent enterprise and its sister facilities and divisions. By sharing and leveraging existing resources, organizations increase their capacity to obtain management process knowledge that is critical for achieving competitive advantage (Wernerfelt, 1984; Grant, 1991; Russo and Fouts, 1997; Collis and Montgomery, 1995; Barney, 1991). Within the environmental setting, resource sharing is especially important because complex environmental initiatives are often implemented in multi-plant organizations and their success depends on the incentives and the resources provided by their parent enterprise (Bowen, 2002). As a result, organizations that receive support from their parent enterprise are more likely to have fewer EMS adoption costs.

Hypothesis 3: Organizations that receive support from their parent enterprise incur fewer EMS adoption costs.

Organizations lacking internal resources may benefit from external support in the form of government-funded grants and technical assistance (Darnall, 2003). Government-funded grants and technical assistance are subsidies that encourage organizations to undertake actions which improve the welfare of society (Stokey and Zeckhauser, 1978). Since 1998 the US Environmental Protection Agency (EPA) and state-level environmental agencies have encouraged organizations to adopt EMSs by offering grants and technical assistance (USEPA, 2001b). Regulators are promoting EMS adoption because they believe that EMSs can help organizations increase their operational efficiencies by improving environmental performance (Andrews *et al*., 2001; USEPA, 2002). At the same time, society may be able to benefit from a cleaner environment (USEPA, 2002). However, government subsidies often fail to encourage socially desirable behavior because of hidden adoption expenses and negligible overall benefits (Weimer and Vining, 1992). In other instances, government is able to design its subsidies appropriately, and hence mitigate adoption costs (Stokey and Zeckhauser, 1978). Because EMSs are knowledge-based systems requiring significant environmental assessments, organizations that lack complementary capabilities and internal resources for EMS adoption may find government-sponsored technical assistance particularly useful. To the extent that adoption costs are mitigated, regulators therefore may be able to encourage the more widespread use of EMS.

Hypothesis 4: Organizations that rely on government assistance reduce their EMS adoption costs.

Other enterprises that lack internal resources and capabilities may rely on external assistance from consultants to bolster their less robust internal proficiencies, thereby making EMS adoption possible. Organizations that utilize external consultants do so in large part because they require outside assistance related to a specialized management concern, although most frequently consultants are called on to help increase organizational efficiency (Dean, 1938). Related to the natural environment, consultants can help assess whether a company should pursue a particular environmental strategy and assist with the adoption of that strategy (Eggers, Villani, and Andrews, 2000). While the 'buying' of external knowledge is one of the simplest and least costly ways for organizations to acquire expertise (Canback, 1998) and improve their internal efficiencies (Dean, 1938), consultant support can also be costly, especially if an organization necessitates multiple consultations over a long duration of time (Marimon, Casadesus, and Heras, 2003). Unlike the outsourcing of financial accounting practices or human resource management, EMS adoption is intended to affect each aspect of an organization's operations. As a result, organizations that adopt an EMS without basic complementary capabilities are expected to rely on consultants not simply for EMS adoption alone, but also to develop some of their deficient complementary capabilities. Similarly, because EMS adoption generally takes between 4 months and 2 years (Andrews *et al*., 2001), organizations utilizing consultant support will likely do so over a long duration of time. For these reasons, we anticipate that organizations, which rely on consultants, increase their EMS adoption costs.

Hypothesis 5: Organizations that rely on consultants increase their EMS adoption costs.

Quality-based and inventory control management systems, pollution prevention practices, and access to resources from parent enterprises, government, and consultants therefore provide a basis to evaluate organizations' EMS adoption costs. These relationships are illustrated in Figure 1.

Despite the hypothesized relationship between complementary capabilities, access to resources, and EMS adoption costs, organizations are not expected to be heterogeneous in their development of complementary capabilities or resources. Rather, enterprises in analogous settings are anticipated to behave similarly, on average, because they seek to reduce the strategic gaps with relevant competitors, in order to gain legitimacy in the eyes of external stakeholders (Meyer and Rowan, 1977; DiMaggio and Powell, 1983). By

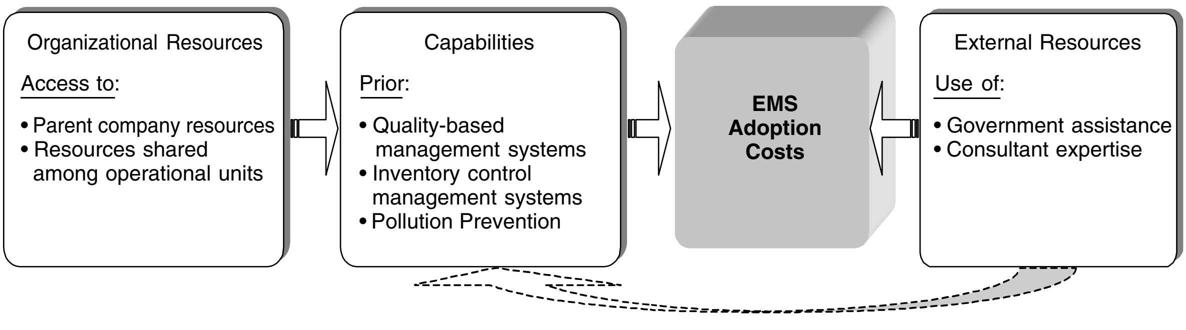

Figure 1. Relationship between resources, capabilities and EMS adoption costs

imitating the observable aspects of successful competitors (Mauri and Michaels, 1998), organizations can reduce the uncertainty associated with developing specialized internal competencies (Alchian, 1950). These arguments may seem incompatible with RBV, which suggests that organizations benefit by creating rare, specialized, difficult-to-replicate resources and capabilities that cause heterogeneities across all types of organizations. However, resource allocation is profoundly influenced by the context of resource decisions (Oliver, 1997; Hoffman, 1997) in large part because institutional settings delimit what strategies organizations can employ (Scott, 2001). For example, in one kind of setting, an organization's management strategies may be encouraged and appropriate, but the same strategies may be discouraged in a different setting (Scott, 2001). These notions suggest that institutions mediate organizational strategy and that managers optimize efficiencies within the constraints of their external settings (Hoffman, 1997).

Applied to the natural environment, the development of organizational capabilities and resources may be a function of imperfect or incomplete market factors, and also of the institutional context of these decisions. Previous research has pointed to the importance of ownership structure as an important institutional factor shaping organizational responses (Mascarenhas, 1989; Gedajlovic, 1993; Darnall, 2003). However, most management research on ownership structure has studied only one or two ownership regimes (Meyer, 1982) and excluded the government enterprise (Mascarenhas, 1989). It therefore is important to address how resources and capabilities differ among the broader population of ownership structures and how these variations affect the costs for EMS adoption.

OWNERSHIP STRUCTURE

Ownership is a summative condition that includes (1) the interests and constraints of respective owners (such as societies, politicians, or private individuals) and of respective managers (such as professional managers, entrepreneurs, or civil servants), as well as conflicts among owners and managers; and (2) the abilities of these parties to obtain resources and factor markets, such as capital, management, and technical talent (Mascarenhas, 1989). The factors that characterize ownership, not ownership per se, result in selected differences in the development of their organizational capabilities and resources.

However, some researchers have questioned whether ownership structure is important as an institutional constraint (Lachman, 1985; Roberts, 1975). For example, Roberts (1975) claimed that publicly traded, privately owned, and government enterprises have wide and possibly overlapping internal features and external circumstances, causing ownership to have no explanatory power over behavior. Others have suggested that ownership is less relevant than organizational size. Size is often included or controlled for in organization studies. Yet size is merely a surrogate for several things poorly understood, and theoretical considerations of why size is important have been absent (Kimberly, 1976; Bowen, 2002), whereas the ownership approach has the potential to explain an organization's strategy with more developed theoretical underpinnings (Mascarenhas, 1989).

There are three important, but unequally studied types of ownership structures: publicly traded, privately held, and government ownership (Mascarenhas, 1989). Publicly traded firms have received much research attention, in part because they are more visible and are required to disclose information about their activities; however, privately owned enterprises constitute the majority of firms (Mascarenhas, 1989). Similarly, government enterprises are studied in management and economic literatures more for their controversy regarding unfair competition in specific industries such as airlines, telecommunications, and aircraft manufacturing (Walters and Monsen, 1979) rather than for how complementary capabilities shape their operational efficiencies. While there is some overlap between ownership structures in funding streams and disposition of revenues, the managerial behavior of organizations within each ownership structure is unique in many respects (James, 1983). There are also clear differences in who is served by the productive capacity of the enterprise and in the general aim of the organization. Each of these factors is anticipated to affect an enterprise's strategic responses (Block, 1990).

For-profit ownership

For-profit organizations operate with revenue-seeking goals and consist of publicly traded companies and privately owned enterprises. As resources enter into both types of organizations they are allocated toward achieving operational efficiency (Miller, 1992). Despite their common goal, these enterprises differ in fundamental ways. Publicly traded firms issue shares that are traded on stock exchanges, which increases the financial resources available to the firm through greater risk sharing among many owners (Fama and Jensen, 1983), and enhances the firm's reputation and visibility (Mascarenhas, 1989). Publicly traded operations also have been shown to operate more assertively when confronted with competitive forces (Khanna and Tice, 2000). For example, these firms respond more aggressively to expanding global competitors (Khanna and Tice, 2000), in part because publicly traded firms have more resources and capabilities to address their competitive forces more quickly.

Applied to a firm's environmental strategy, the publicly traded organization has greater access to financial resources that can be used to develop their internal environmental expertise (Bowen, 2002; Russo and Fouts, 1997). These organizations also share resources between parent corporations and their operational units (Bowen, 2002), creating greater economies of scale and greater opportunities for employees to expand their environmental knowledge and management skills.

By contrast, ownership within the privately owned firm is typically concentrated in few residual risk bearers, whose resources are generally more constrained (Johannson, 1997; Gilmore, Carson, and Grant, 2001; Terziovski, 2003). These risk bearers are generally owner-managers who are often unwilling to dilute their personal and family control over their business (Pondy, 1969), thus limiting the organization's ability to grow beyond the owner's managerial capability (Mascarenhas, 1989). As a result, the privately owned firm is more likely to limit its depth and specialization (Mascarenhas, 1989). Reduced specialization, coupled with a more concentrated risk residual, causes the privately owned enterprise to have greater concerns for its short-term economic viability, which has important consequences for its strategic decisions (Bianchi and Noci, 1998). For instance, the risk of employee turnover (Marshall *et al.*, 1995) prevents many privately owned companies from offering employees professional development opportunities (Finegold and Soskice, 1988), such as specialized environmental training. Such resistance is rooted in the belief that training internal staff in highly specialized environmental management techniques may encourage personnel to seek employment opportunities with more branded companies (Johannson, 1997).

In instances where privately owned operations elect to develop their environmental competencies, such decisions are more often a response to supply chain requirements by manufacturers' associations (Bianchi and Noci, 1998) or by networks of similar companies (Gilmore *et al.*, 2001) rather than by proactive managers within the firm. Because advanced environmental management strategies often involve longer-term strategic goals (Hart, 1995), the privately owned enterprise therefore is less likely to invest in developing its complementary capabilities that would support strategies (such as EMS adoption), which are focused on the long term. Faced with fewer resources, greater risk of employee flight, and greater challenges in creating long-term strategies, privately owned enterprises rely more often on expertise from external sources (Shaper and Raar, 2000) such as professional consultants and government-provided technical assistance. While government-sponsored technical assistance is intended to facilitate EMS adoption, it does not cultivate the full range of complementary capabilities that are generally lacking in the privately owned enterprise. For these reasons, privately owned organizations are expected, on average, to have *higher* EMS adoption costs than publicly traded companies.

Hypothesis 6: Compared to privately owned enterprises, publicly traded organizations have fewer EMS adoption costs.

Government ownership

By contrast to the for-profit firm, the objective of government operations is to address public welfare. Government enterprises exist to ensure equal access to goods and services that cannot be acquired reliably through the private market (Downs and Larkey, 1986). Such objectives are more numerous, diverse, and often intangible. For example, municipalities generally govern urban areas and have the responsibility for providing basic health and sanitation services, public education and infrastructure. By governing an assortment of unrelated services, rather than concentrating expertise and organizational goals, government enterprises generally exhibit lower operating efficiency (Mascarenhas, 1989). Government entities are also more likely to provide labor-intensive services (Bartlett, 1998). While higher-order environmental management activities are generally people intensive (Hart, 1995), government enterprises are less likely to allocate their labor toward pollution prevention or toward similar competencies because they have fewer slack resources than for-profit enterprises (Kettl, 1993). Less organizational slack is due in part to the fact that the government manager has less autonomy than managers of other ownership structures. For instance, regulatory protocols, such as civil service policies and rigid hierarchical reporting requirements to government controllers (Mascarenhas, 1989), as well as political relationships (Fottler, 1981), restrict government managers' control over their workforce and their ability to lay off or fire employees. Further, the performance of government services is more difficult to measure because performance is not evaluated by the consumer, but by political actors (Fottler, 1981). Because of these constraints, and absent a competitive environment, government organizations have fewer reasons to invest in developing their complementary capabilities (Kettl, 1993) that would facilitate EMS adoption. Government entities that choose to pursue EMS adoption therefore are expected to rely more on external consultants and state-sponsored subsidies to bolster their limited internal expertise.

Hypothesis 7: Compared to privately owned and publicly traded organizations, government has the highest EMS adoption costs.

METHODS AND SAMPLE

The seven hypotheses were tested using data from the National Database of Environmental Management Systems (NDEMS). NDEMS contains survey data for all facilities that participated in a nationwide EMS pilot program sponsored jointly by the Multi-state Working Group on Environmental Performance and EPA. Approximately 80 US-based facilities in 10 states contributed information about their EMS design process over a 3-year period. Access to data such as these is uncommon since obtaining information about management design processes often requires organizations to disclose confidential business information, as well as document management activities over an extended period of time. For these reasons, for-profit companies generally are reluctant to provide information about these types of activities.

In return for providing their EMS adoption data, some organizations (that requested assistance) received small grants for EMS design training and technical assistance, in addition to data collection support. These benefits may have influenced some organizations to contribute data and therefore created a unique opportunity to evaluate whether the provision of government subsidies mitigated EMS adoption costs for different ownership structures.

Two conditions were imposed before including a facility in this study. First, the facility had to have contributed EMS adoption data for the questions of interest. Second, facilities were required to have implemented their environmental policy, identified their environmental aspects and impacts, and established their objectives and targets. A more robust measure of EMS adoption costs would have further restricted the sample to organizations that already had their EMS undergo monitoring and management review. However, 80 percent of development costs are generally associated with the first 20 percent of managerial and design planning (Lewis and Gretsakis, 2001). Our measure was anticipated to account for significantly more than 80 percent of EMS adoption costs because the first three stages encompass about three-quarters of the EMS adoption process (Stapelton *et al*., 2001). Forty-two facilities were included in the analysis: 20 publicly traded, 16 privately owned and six government enterprises. The sample represented 53 percent of the NDEMS facilities and 69 percent of NDEMS facilities that reported EMS adoption data.

The dependent variable, EMS adoption costs, was measured using facilities' self-reported expenditure data. These data were enormously rich in that they included expenditures for the most common types of EMS adoption costs: staff time, consultants, travel and training, equipment, materials, corrective action, auditors and ISO 14001 certification[1] (Stapelton *et al*., 2001). To ensure the data

[1] Some organizations choose to adopt ISO 14001-certified EMSs while others adopted non-certified EMSs. For facilities that adopted ISO 14001, certification was a cost associated with their EMS adoption process, and therefore included in our analysis.

were of high quality, NDEMS researchers asked facilities about their adoption costs as they were adopting their EMSs. NDEMS researchers met with facility managers in person to train them on what type of information was relevant to the data collection process. Facility managers then were surveyed about their EMS adoption costs at multiple points throughout their adoption process. At each point, data were then entered into NDEMS and each database record was sent back to the facility for validation. The data collection process was intensive, spanning more than 3 years and involving extensive contact with facility managers. Such procedures were necessary to accurately measure each facility's EMS adoption costs.

To evaluate Hypotheses 1–5, we summed each facility's EMS adoption expenditures. We then logged the cost data to reduce the variability in the dependent variable.[2]

To measure experience with quality-based management systems, facilities were asked whether they had implemented Total Quality Management principles (TQM) prior to EMS adoption or ISO 9000 quality-based management systems. Organizations that adopt TQM incorporate the principles of product quality, process control, quality assurance, and continual quality improvement (Kitazawa and Sarkis, 2000) throughout their operational units. Similarly, ISO 9000 is a set of generic standards focused on the continual improvement of product and process quality through management planning and implementation (ISO, 2001). Like ISO 14001, enterprises that certify to ISO 9000 rely on external auditors to ensure that they adhere to the quality-based management standard.

To assess experience with inventory control management systems, facilities were asked whether they had implemented Just-in-Time inventory management (JIT) or materials accounting. Implementation of JIT requires an organization-wide commitment to reducing product and process inputs and a culture of setting production goals within narrow windows of time. Similarly, materials accounting systems are a generic class of management system that focuses on continually reducing the use of toxic inputs. Like JIT and quality-based management systems, organizations that adopt materials accounting have organization-wide commitments to achieve common goals for continual improvement and to develop a tacit knowledge of interlinking processes. Organizations that had implemented TQM, ISO 9000, JIT and materials accounting management systems were expected to have more quality-based and inventory control management system experience than organizations lacking these systems.

Facilities' pollution prevention practices were measured by whether they had participated in pollution prevention activities prior to adopting an EMS. Pollution prevention activities were defined as any materials substitution, process changes, or other activities that minimized waste production.[3] In addition, we accounted for whether or not the enterprise had adopted a pollution prevention plan or incorporated pollution prevention strategies into their future business planning. Organizations that indicated that they had implemented any one of these proactive environmental strategies were believed to have more pollution prevention practices than organizations that elected not to do so.

To account for the support organizations received from their parent enterprise two measures were also included. First, we determined whether the facilities had parent organizations. Approximately 90 percent of publicly traded facilities, 69 percent of privately owned companies, and 83 percent of government enterprises reported either being part of a larger organization or having a parent enterprise. We then assessed whether the parent organization provided the following forms of EMS adoption assistance: (1) financial support, (2) technical support, or (3) an EMS design template.

To measure the extent to which facilities relied on government subsidies during EMS adoption, we asked whether EPA or state-sponsored technical assistance influenced their EMS adoption decision. Facility managers responded by indicating whether this assistance had a high, medium, or low influence.[4] Consultant assistance was measured by

[2] EMS adoption costs did not include sunk costs (such as the expense of developing a pollution prevention plan). These expenditures cannot be recovered and their opportunity cost therefore is zero (Behn, 1981; Leman and Nelson, 1981) in that they exist whether or not the organization adopts an EMS.

[3] Pollution prevention does not include activities such as pollution recycling/reuse (other than in-process recycling), waste treatment, and disposal of waste or its release into the environment because in each of these examples waste is first produced and later controlled.

[4] The ordinal scale also includes a 'not applicable' category. Because of the ambiguousness between the 'low' and 'not applicable' classifications, these two responses were collapsed into the 'low' category.

including a dummy variable indicating whether or not facilities relied on external consultants during EMS adoption.

Finally, several control variables were included. The first was the number of employees within each organization that were covered by the EMS during the year 2000. The rationale for including an organizational size variable was that evaluating ownership in conjunction with size provided a basis of comparison and a more stringent test of the effects of ownership structure (Mascarenhas, 1989). We also included a dummy variable indicating whether or not the facility was certified to or seeking ISO 14001 certification. Finally, we tested for industry differences using five industry dummies representing two-digit SIC codes 20–29, 30–34, 35–39, 40–49, and government. Industry dummies were modeled in a series of secondary models by estimating the industry dummies without the other explanatory variables, and then with the other explanatory variables. We also estimated the main effects model after combining the 30–34 and 35–39 SIC dummies. Sample size constraints prevented us from creating more precise industry dummies.

Linear regression was used to determine whether the independent variables predicted facilities' EMS adoption costs (Hypotheses 1–5). To correct for heteroskedasticity, the dependent variable (cost) was estimated using generalized least squares regression. Robust standard errors were used, as was clustering by ownership structure to take advantage of the fact that the observations were independent across ownership structure. By summing over the clusters, correlations between facilities within the same cluster were measured. While clustering affects the variable estimates, in general the bias is downward (Hardin and Hilbe, 2001). The same was also true for our small sample (Cohen, 1988), suggesting that if statistically significant relationships were found additional evidence would be provided about the strength of the relationships (Hoenig and Heisey, 2001; Gillett, 1989).

In cases where a statistical relationship was not found, we evaluated confidence intervals to determine whether the insignificant results were caused by a valid lack of association between the dependent and independent variables or because of lack of statistical power. Using Gillett's (1989) recommended methodology, confidence intervals that were narrow illustrated that the sample size was large enough to rule out the possibility that a relationship existed. By contrast, wide confidence intervals that occurred within the range of statistical indifference and in the expected direction indicated that the sample size was too small to rule out a possible relationship. Because we used multiple measures of each construct, in cases where low statistical power appeared to be the cause of statistical insignificance, we considered whether the other construct measures were also insignificant. If so, then additional evidence would be provided about the lack of importance for this construct in predicting EMS adoption costs.

Variable correlations and descriptive statistics are shown in Table 1. An evaluation of the correlations and the variance inflation factors indicated that multicollinearity was not a concern (Kennedy, 1997).

The second empirical technique we used was the Wilcoxon–Mann–Whitney (WMW) test to evaluate whether EMS adoption costs differed among the three types of ownership structures (Hypotheses 6 and 7). In interpreting the results of this test, the continuous variable (cost per employee) was the dependent variable and ownership structure was the independent variable. Finally, we used the WMW and Fisher's exact test to determine whether internal capabilities and access to resources differed by ownership structure in cases where a statistically significant relationship was found in the linear regression estimations. The WMW and Fisher's exact techniques are nonparametric tests of association and are appropriate for small samples (Stokes, Davis, and Koch, 1995) because they make no normality assumptions.[5] In adjusting for sample size, these tests estimate highly conservative p-values, which is why in addition to the conventional levels of significance ($p \leq 0.01$ to 0.05) more liberal levels ($p \leq 0.10$) are also reported (Donguk and Agresti, 1995). One-tailed tests are reported for 2×2 comparisons, since each of the hypotheses specify direction, and two-tailed test results are reported for 2×3 comparisons.[6]

[5] The WMW test and Fisher's exact test are analogous to an analysis of variance test (ANOVA) and chi-square test, respectively, and in larger samples yield statistically equivalent results.

[6] One-tailed Fisher's exact tests cannot be calculated for 2×3 contingency tables.

Table 1. Correlations and descriptive statistics

Correlations	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
TQM (1)	1.000										
ISO 9000 (2)	0.209	1.000									
Inventory control mgt system (3)	0.145	0.153	1.000								
P2 activities (4)	0.121	0.146	−0.009	1.000							
Formal P2 plan (5)	0.278	0.030	−0.290	0.405*	1.000						
P2 in business planning (6)	0.195	0.087	−0.029	0.303	0.555*	1.000					
Workers covered by EMS (7)	0.375*	0.247	0.142	0.155	0.237	0.367*	1.000				
Parent organization (8)	0.235	0.341*	0.081	−0.178	0.046	0.029	−0.018	1.000			
Consultant assistance (9)	0.037	−0.109	0.109	−0.121	−0.178	−0.195	−0.183	0.271	1.000		
Government assistance (10)	−0.241	−0.189	−0.167	−0.221	−0.304	−0.422*	−0.240	−0.367*	−0.009	1.000	
ISO 14001 certification (11)	−0.008	0.171	−0.125	−0.052	−0.215	−0.171	−0.150	0.125	0.347*	−0.084	1.000
Mean	0.357	0.595	0.191	0.881	0.548	0.405	510.26	0.801	0.643	0.524	0.738
S.D.	0.485	0.499	0.397	0.328	0.504	0.497	851.14	0.397	0.485	0.804	0.445

* $p \leq 0.05$

Table 2. Results of prediction model for EMS adoption costs

Independent variable	Coefficient	Robust S.E.	*Z*	95% confidence interval	
Continual improvement expertise					
TQM principles	−0.570	0.108	−5.17***	−0.767	−0.345
ISO 9000 certification	0.283	0.326	0.89	−0.350	0.928
JIT/materials accounting inventory system	−0.785	0.228	−3.40***	−1.221	−0.329
Pollution prevention practices					
Pollution prevention activities	−0.275	0.303	−0.78	−0.830	0.359
Pollution prevention plan	0.188	0.194	1.32	−0.125	0.635
Pollution prevention in business planning	−0.729	0.176	−3.83***	−1.020	−0.330
Resource access					
Existence of parent enterprise	0.660	0.317	2.05**	0.029	1.273
Required consultant support	0.962	0.141	7.12***	0.727	1.279
Government assistance	−0.500	0.105	−4.91***	−0.745	−0.320
Controls					
Number of employees covered by the EMS	0.001	0.000	5.04***	0.0004	0.001
ISO 14001 certification	−0.384	0.175	−1.47	−0.601	0.086
Constant	10.410	0.170	61.17***	10.077	10.744
Observations	42				
R^2	0.599				

*** $p \leq 0.01$; ** $p \leq 0.05$; * $p \leq 0.10$

RESULTS

Predicting EMS adoption cost

Do organizations with higher capabilities and greater access to resources have lower EMS adoption costs? The results of the regression model, shown in Table 2, suggest that they do. After controlling for ownership structure effects, the estimates show that facilities' prior experience with quality-based and inventory control management systems and pollution prevention, along with access to parent organization and external resources, predicted about 60 percent of the variance in the cost of adopting an EMS ($R^2 = 0.599$).

All other variables held constant, facilities with prior TQM experience and experience with inventory control systems (either JIT or materials accounting) incurred fewer EMS adoption costs than facilities that did not employ these management systems. These results offer support for the notion that experience with quality-based and inventory control management systems reduce the cost of EMS adoption (Hypothesis 1). Similarly, facilities that incorporated pollution prevention into their business planning incurred fewer EMS adoption costs, providing support for Hypothesis 2.

Facilities with parent enterprises incurred greater adoption costs, which was somewhat contrary to Hypothesis 3. However, the presence or absence of a parent enterprise is a crude measure of whether or not a facility receives support from their parent enterprise. To further explore the issue of parent enterprise support, in a series of additional estimation models, we examined whether parent-sponsored financial support, technical support, or support in the form of EMS templates reduced adoption costs. The results showed that parent organizations that provided support in the form of an EMS template successfully reduced their facilities' EMS adoption costs, offering evidence for Hypothesis 3 (financial and technical support had no statistical effect).

As expected, facilities that relied on government assistance incurred fewer EMS adoption expenses, suggesting that EPA and state-sponsored EMS adoption subsidies were effective at mitigating adoption costs (Hypotheses 4) and may encourage additional organizations to adopt an EMS. By contrast, organizations that relied on consultant support incurred higher EMS adoption costs (Hypotheses 5).

The number of employees covered by the EMS (our organizational size variable) was also significant. Evaluating size in conjunction with ownership provided a basis of comparison and a more stringent test of the ownership approach. To further explore the relationship between facility size and ownership, we correlated the variables using

Spearman rank-order correlation (for qualitative variables) to ensure that the two variables were distinct. These correlations were statistically insignificant, suggesting that ownership is a unique feature influencing organizational strategy.

None of our industry dummies predicted EMS adoption costs, most likely because our measures were not as precise as we would have desired. In exploring the lack of statistical significance in these variables, the wide confidence intervals, which occurred within the range of statistical indifference, indicated that the sample size was too small to rule out a possible relationship (Gillett, 1989). Future research should therefore study these relationships further. ISO 14001 certification also did not predict the cost of EMS adoption.

In summary, our regression results offer evidence for our expectations that organizational capabilities and resources predict EMS adoption costs, and that ownership is an important (and distinct) feature deserving additional investigation.

Differences in EMS adoption costs by ownership structure

Table 3 explores whether the costs of EMS adoption differed across ownership structures. It shows that compared to privately owned and government organizations, publicly traded organizations incurred lower overall costs when adopting their EMS ($p = 0.04$), while government facilities spent the most ($p = 0.03$). Publicly traded facilities spent approximately $268 per employee, in contrast to the $531 and $1441 that privately owned facilities and government entities spent, respectively. These findings provided the basis for a more in-depth examination of why costs variations existed among facilities of different ownership structures.

In assessing these differences, Table 4 shows that variations may be due largely to internal capabilities and access to resources, which supports Hypotheses 6 and 7. While the percentage of publicly traded and privately owned facilities that adopted TQM were similar (48% and 31%, respectively), they differed from government facilities ($p = 0.05$), in that none of the government facilities had implemented TQM principles prior to EMS adoption. Differences also existed in whether facilities had implemented inventory control systems (either JIT or materials accounting) prior to EMS adoption ($p = 0.01$). More specifically, 76 percent of publicly traded facilities had implemented inventory control systems, whereas 50 percent of privately owned facilities, and no government enterprises had implemented these systems.

With respect to facilities' prior pollution prevention practices, none of the government facilities reported that they considered pollution prevention in their management planning, while nearly one-half of the publicly traded and privately owned companies reported such experience (48% and 44%, respectively; $p = 0.04$). Despite the fact that there were no differences associated with whether the organizations in our sample had a parent organization, publicly traded facilities received more support from their parent enterprise (68%) in the form of a pre-designed EMS template. By contrast,

Table 3. Costs of EMS adoption per employee by ownership structure

Cost category	Publicly traded ($n = 20$)			Privately owned ($n = 16$)			Government (n = 6)*		
	Mean	S.D.	Percent	Mean	S.D.	Percent	Mean	S.D.	Percent
Labor	$206	219.5	76.9%	$317	371.6	59.7%	$822	1041.6	59.8%
Consultants	$12	19.9	4.5%	$37	60.6	7.0%	$499	775.6	36.3%
Travel/training	$14	32.2	5.2%	$34	99.8	6.4%	$50	111.8	3.6%
Equipment	$0	1.7	0.0%	$33	88.9	6.2%	$0	0.0	0.0%
Materials	$7	14.6	2.6%	$22	46.6	4.1%	$1	1.5	0.1%
Auditors	$12	29.0	4.5%	$19	36.3	3.6%	$0	0.0	0.0%
Certification	$17	35.5	6.3%	$69	120.8	13.0%	$0	0.0	0.0%
Avg. total cost/employee	$268**		100%	$531**		100%	$1372**		100%

* One government facility was unable to provide estimates of their individual EMS implementation costs, but instead reported its total costs. Since our estimates were based on total costs, we included the facility in our analysis.
** Costs were less for publicly traded facilities than for other facilities ($p = 0.04$). For-profit (publicly traded and privately owned) costs were less than government costs ($p = 0.03$). In comparing all three ownership structures jointly, EMS adoption costs per employee also differed ($p = 0.08$).

Table 4. Differences among ownership structures and facilities' complementary capabilities and resource access

Variable	Facility characteristic:			Statistical differences between:*		
	Publicly traded ($n = 20$)	Privately owned ($n = 16$)	Government ($n = 6$)	All three ownership structures	For-profit/ government	Publicly traded/privately owned
Continual improvement expertise						
TQM practices	48%	31%	0%	—	0.05	—
JIT/materials accounting inventory system	76%	50%	0%	0.01	0.01	0.10
Pollution prevention expertise						
Pollution prevention in business planning	48%	44%	0%	—	0.04	—
Resource access						
Existence of parent enterprise	90%	69%	83%	—	—	—
—Parent provides EMS template	68%	18%	0%	0.01	0.05	0.01
Utilized consultant services	33%	69%	50%	0.10	—	0.03
—Dollars spent on consultants**	$12	$37	$499	0.04	0.02	—
Government assistance was an important motivator for EMS adoption	10%	44%	83%	0.01	0.01	0.01
Controls						
Number of employees***	736	320	258	—	0.09	0.07

* Exact p-values are reported.
** Represents a continuous variable and is a value per employee.
*** Represents a continuous variable and is a mean value.

none of the government facilities and 18 percent of privately owned facilities ($p = 0.05$) received EMS templates.

The dearth of in-kind support by parent enterprises, coupled with their lower overall capabilities, appears to explain why government facilities relied on state-sponsored subsidies and consultant services to a greater extent than publicly traded and privately owned facilities. More than three-quarters (83%) of government facilities reported that state-sponsored assistance was an important motivator for EMS adoption, as compared to 44 percent of privately owned facilities and 10 percent of publicly traded organizations ($p = 0.01$). In spite of this assistance, government facilities still spent more on EMS adoption than enterprises with stronger foundational capabilities, perhaps because government facilities also spent 13 times more per employee on consultants than privately owned facilities and 41 times more than publicly traded facilities ($p = 0.02$). Privately owned facilities spent no more on consultant services than publicly traded facilities, but relied more on government subsidies ($p = 0.01$). Combined, these results indicate that access to external resources were more relevant to organizations with less robust complementary capabilities and internal resources prior to EMS adoption.

In summary, our empirical results offer evidence that organizational resources and capabilities predicted the cost of EMS adoption and that resources and capabilities varied by ownership structure.

DISCUSSION AND CONCLUSIONS

This study begins to understand the factors that predict EMS adoption cost, and how these costs vary for different ownership structures. Consistent with the relationships presented in Figure 1, the results suggest that a facility's internal capabilities and access to resources predicted its EMS adoption cost. Facilities with stronger internal capabilities prior to EMS adoption incurred *lower* EMS adoption costs and relied on external resources to a *lesser* extent, whereas facilities with fewer organizational capabilities incurred *higher* adoption costs and relied on external resources to a *greater* extent. Of the three ownership structures considered, publicly traded facilities incurred the lowest EMS adoption costs, had the strongest internal competencies prior to EMS adoption, and were influenced less frequently by external resources. By contrast, government facilities had the weakest internal competencies, relied on external resources more frequently, and had the most costly EMS adoption process. Privately owned facilities fell in between the two extremes with moderate internal capabilities, external resource use, and EMS adoption costs.

These findings fuel the basic debate concerning whether organizational strategy emerges freely through strategic choice or whether it is determined by institutional settings (Mascarenhas, 1989; Gedajlovic, 1993; Oliver, 1997). Related to institutional factors, our research shows that enterprises in analogous ownership structures behaved similarly in that they developed similar management systems and pollution prevention practices, and utilized external support in equivalent ways. These patterns support prior research indicating that organizations in comparable settings reduce their strategic gaps with relevant competitors to gain legitimacy in the eyes of external stakeholders (Meyer and Rowan, 1977; DiMaggio and Powell, 1983). By imitating the observable aspects of successful competitors (Mauri and Michaels, 1998), organizations can reduce the uncertainty associated with developing specialized internal competencies (Alchian, 1950), such as pollution prevention strategies (Hoffman, 1997) and quality-based (Westphal, Gulati, and Shortell, 1997) and inventory control management systems. Such arguments may seem incompatible with RBV, in that the basic tenets of RBV indicate that organizations benefit by creating rare, specialized, difficult-to-replicate resources and capabilities that cause heterogeneities across all types of organizations. However, our findings reinforce the notion that strategy emerges as owners and managers pursue their individual and diverse interests while coping with their institutional settings (Hoffman, 1997; Mascarenhas, 1989). As such, heterogeneities in organizational resources and the ability to mobilize these resources arise within an institutional setting (Barney, 1991), indicating that resource allocation also is influenced by the external context (Oliver, 1997; Hoffman, 1997). Institutional settings therefore delimit what strategies organizations can employ (Scott, 2001) and the development of organizational capabilities and resources is a function of imperfect or incomplete market factors, and also institutional factors.

For the enterprises included in our study, the evidence showed that ownership structure mediated their organizational strategy, even after controlling for size. As such, ownership structure appears to be a distinct institutional constraint that influences an organization's strategy (Mascarenhas, 1989). This point is notable because organizational researchers routinely control for organizational size. However, ownership structures also may be important to consider, at least as they relate to the complementary capabilities of organizations' environmental strategies. Similarly, ownership structure may also be relevant in other settings (Mascarenhas, 1989), and additional research is needed to understand the degree to which this often neglected variable affects organizations' strategic behaviors (Pondy, 1969).

With respect to organizations' internal competencies, our findings support the idea that enterprises that have basic complementary competencies may benefit when they adopt advanced environmental management practices (Hart, 1995; Christmann, 2000). More specifically, the organizations included in our study demonstrated a path dependence when adopting a low-cost EMS in that enterprises first had to develop their basic complementary competencies in order to reduce costs during EMS adoption. While the notion of path dependence in developing environmental capabilities is not new (Hart, 1995; Kunes, 2001; Christmann, 2000), our study offers important empirical evidence that illustrates its existence and its effect on the cost of adopting an advanced environmental strategy.

However, for the organizations in this study, path dependence in capability development was weak since some enterprises adopted an EMS in spite of not having complementary capabilities. In adopting their EMS, these organizations were able to rely on external assistance from government subsidies and consultants. Government subsidies (in the form of grants and technical support) reduced the cost of EMS adoption; however, organizations that relied on this assistance still spent more on EMS adoption than enterprises with stronger foundational capabilities. The greater expense was most likely due to the fact that these organizations also relied on external support from consultants to facilitate EMS adoption and assist in developing the enterprise's basic foundational competencies. While consultant support can help organizations acquire expertise (Canback, 1998) and improve their internal efficiencies (Dean, 1938), it increased the overall cost of EMS adoption for the organizations in this study. As such, while circumventing the development of basic complementary capabilities was possible, overcoming this path dependence came with monetary penalty.

These issues raise important theoretical questions for future research regarding the long-term benefits of EMSs and other advanced environmental strategies that are developed internally as opposed to those that are developed with external support. Organizations that require external assistance may not have the internal capacity to achieve the same environmental improvements over time, since they are not as skillful at generating momentum towards encouraging commitments to stronger environmental management, and since they lack the expertise to achieve continual environmental improvements. As such, these enterprises eventually may abandon their EMS or settle for less ambitious environmental goals. On the other hand, EMS adopters that rely on external assistance may have a greater opportunity to make small changes in their management strategy that lead to tremendous improvements to their environmental performance. Significant improvements may accrue because these enterprises are more likely to have extensive 'low-hanging fruit' that allows them to undertake inexpensive operational changes, which result in large pollution reductions relative to cost (Hart and Ahuja, 1996).

By contrast, organizations with strong complementary capabilities may adopt EMSs with more aggressive environmental goals by extending their existing proficiencies in pollution prevention and formalizing managerial commitment (Rondinelli and Vastag, 2000). These enterprises therefore may achieve greater environmental improvements over time because they can more efficiently leverage their internal expertise and facilitate continual environmental improvements that improve organizational efficiency (Christmann, 2000). Alternatively, organizations with strong complementary capabilities may experience only modest environmental improvements because much of their low-hanging fruit has been picked. Future studies evaluating the environmental performance of EMS adopters should explore these issues to understand how external support and complementary capabilities affect environmental performance changes over time.

With respect to practice, this study is relevant to managers who are faced with making a strategic decision about whether or not to adopt an EMS. By understanding that prior capabilities predict the cost of EMS adoption for the organizations in this study, managers may be able to assess their organization's internal structures and determine how much they might need to invest when adopting an EMS. Still other managers, who seek to elevate environmental concerns within their organization, may benefit from the knowledge that their organization's complementary capabilities may create internal efficiencies that can be leveraged to reinforce and extend their environmental programs. Both sources of information may also help managers build internal support for or against proposed environmental strategies.

Related to public policy, EPA and state-level environmental agencies are offering technical assistance and small grants to encourage all types of organizations to adopt EMSs. However, such incentives may be less relevant to publicly traded enterprises since they had little influence on organizational decisions to implement an EMS. Publicly traded organizations therefore may need stronger regulatory incentives to encourage more extensive EMS adoption. At the same time, regulators may be challenged by encouraging more widespread EMS adoption among privately owned and government entities because they possess fewer complementary capabilities as compared to the publicly traded firm. While technical assistance and grants appear to have mitigated a portion of EMS adoption costs, privately owned and government enterprises had fewer quality-based and inventory control management systems, and less pollution prevention in business planning, and therefore paid between two and six times more to adopt their EMS than publicly traded companies. These patterns suggest that EMS adoption will be less common among privately owned and government enterprises, unless subsidies are increased significantly. For example, regulators could provide additional incentives to organizations that participate in government-sponsored voluntary programs that promote pollution prevention or materials accounting practices. By doing so, these organizations may be able to develop stronger internal capabilities and adopt less costly EMSs at a later time.

With respect to the generalizability of our findings, our study identifies important patterns that may be relevant to understanding broader trends in organizational strategy. This point is critical because management strategy often has neglected to study the influence of ownership structure on organizational actions (Mascarenhas, 1989) and the practice of combining RBV and institutional theory is still infrequent, but needed (Oliver, 1997). Moreover, collecting data for the constructs we studied was costly. Therefore, primary research in this field is critical before initiating a larger study. Our work provides important evidence that undertaking a larger study has merit and that the relationships we studied deserve additional attention in organizational research.

In sum, this study takes an initial step at evaluating an organization's EMS adoption costs. The results support RBV and institutional theory suggesting that an organization's prior internal competencies predicted its EMS adoption costs, and the development of these competencies was mediated by its ownership structure. Both theoretical perspectives considered together provide a more complete view of the cost of adopting an environmental strategy and have important implications for future research in organizational studies.

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