Government Incentives and How They Encourage Manufacturing Facilities to Adopt Environmental Management Systems: A Look at the Efficiency of Policy Tools

by

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ABSTRACT

Traditional methods of environmental regulation and enforcement have been questioned over the last decade. Due to the number of environmental regulations, and subsequent cost of enforcement, governments have begun to incentivize the adoption of environmental management systems (EMSs). These management systems encourage companies to better manage their environmental performance voluntarily. It is the purpose of this study to list the types of government incentives that have been used and categorize them into three groups based off of their characteristics. Ten incentive types were identified and put into three categories; (a) reducing the barriers to EMS adoption; (b) enhancing benefits derived from EMS adoption, and (c) rewarding EMS implementers with reduced enforcement. The research shows that each category of incentives encourages different manufacturing facilities to adopt EMSs. Using data from previously conducted case studies and surveys to determine what type of manufacturing facilities are affected, this study finds that government incentives have been shown to have a measurable impact on the decision makers of manufacturing facilities to adopt an EMS. The study concludes that a combination of traditional environmental regulation used with targeted incentives provide the most efficient use of resources by governments.

DEDICATION

This thesis is dedicated to my very supportive wife Judith and my family. I especially would like to thank my grandmother Billie Urie for her encouragement over the last year of this project.

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LIST OF ACRONYMS AND DEFINITIONS

BS 7750: British Standard 7750 for environmental management. Developed in 1992 by the British Standards Institute, this was the first formal standard adopted for environmental mangement (Bracke & Albrecht, 2007).

EMAS: Eco-Management and Audit Scheme. This voluntary environmental audit scheme was established by the European Commision with the objective to improve environmental performance of organizations through evaluation and reduction of environmental impacts (European Commission, n.d.).

EMS: Environmental Management System. "A problem identification and problem solving tool that provides organizations with a method to systematically manage their environmental activities, products and services and helps to achieve their environmental obligations and performance goals" (European Commission, n.d.).

ISO 14001: International Organization for Standardization (ISO) standard for environmental management. Published in 1996 the standard is used as an instrument to control potential environmental damage (Watson & Emery, 2004).

NSMD: Non-State Market Driven. Governance systems that develop and implement environmentally responsible management practices through the use of authority achieved through market forces and supply chains rather than traditional state authority (Cashore, 2002).

OECD: Organization for Economic and Co-operation and Development. A forum of thirty democracies that work to address the economic, social and environmental challenges presented by globalization. (OECD, 2007)

Project XL: United States Environmental Protection Agency's Excellence in Leadership Project. A national pilot program that ran from 1995 to 2002 to help businesses test and innovate cost effective methods to protect the environment (United States Environmental Protection Agency [EPA], n.d.)

VEP: Voluntary Environmental Program. Commitments that have the intention to protect the environment and are not required by law (Henriques and Sadorsky, 2008).

SME: Small and Medium Enterprises. Businesses with less than 250 employees and a balance sheet valuation not exceeding 43 million Euros (Labonne, 2006)

USEPA United States Environmental Protection Agency. The national environmental protection agency in the United States (Darnall & Pavlichev, 2005)

Chapter 1

INTRODUCTION

What role should a voluntary regulation of pollution emissions and energy efficiency have in a regulatory environment? Voluntary environmental programs have become increasingly popular with governments and regulators over the past two decades. Although there is evidence that companies will seek only profits and disregard the environment wherever possible (McGuire, 1982), the innovation and cost reductions that come from improved efficiency and reduced waste has caused many manufacturing facilities to go beyond the minimum environmental regulations required by law.

As traditional environmental regulation became prominent in the most developed countries in the early 1970's, some economists became concerned that regulations were driving the cost of manufacturing up and impairing the competitiveness of United States or other Organisation for Economic Co-operation and Development (OECD) countries by encouraging the relocation of pollution intensive manufacturing abroad (Jaffe, Peterson & Stavins, 1995; Jenkins, 1998; Krugman, 1994; McGuire, 1982; Pethig, 1976). Environmental regulations were thought to impose a burden on manufacturing facilities that could slow growth and hinder their ability to compete with similar facilities located in countries with less restrictive environmental regulations (Jaffe et al., 1995).

In the 1990's economists began a trend of challenging this conventional economic approach in the academic literature. Studies were published showing that only after entering into more stringent regulatory programs would companies revaluate their existing processes to achieve maximum efficiency and overall cost savings due to waste reduction or improved energy efficiency (DeCanio, 1993; Dorfman, Muir & Miller, 1992; Jenkins, 1998). A growing amount of the

academic literature began to show environmental management could help achieve more stringent compliance requirements and also identify previously unfound efficiencies that could increase productivity or reduce the cost of waste (Jenkins, 1998).

Beginning in the 1970s manufacturing facilities in North America began implementing EMSs to help manage the change that new environmental regulation was having on their business (Bracke & Albrecht, 2007). By the early 1990s there was a desire to standardize an EMS that could be more widely applied across corporations with multiple manufacturing facilities. In 1992, the British Standards Institution published the first national environmental management standard BS7750 (Bracke & Albrecht, 2007). Today International Organization for Standardization (ISO) 14001 has become the recognized international standard for environmental management with over 223,000 certifications in 159 countries (International Organization for Standardization [ISO], 2010).

Although the demand for the perceived benefits of operating with ISO 14001:2004 standard is wide spread, the distribution of certifications are not evenly distributed throughout the world. As of December 2009, the top ten countries in terms of ISO 14001 certifications issued included China (55,316), Japan (39,556), Spain (16,527), Italy (14,524), United Kingdom (10,912), Republic of Korea (7,843), Romania (6,863), Germany (5,865), United States (5,225), and Czech Republic (4,684) (ISO, 2010). At first glance, this list includes the industrial and exporting powerhouses of the world with a few notable exceptions such as France, India, Canada, Brazil, and the Netherlands.

However it is clear that the motivations for a facility to seek ISO 14001:2004 certification differ greatly from country to country.

Although the ISO 14001 is the dominant international standard, other less dominant regional standards also exist. Looking specifically at the Eco-Management and Audit Scheme (EMAS) standard in Europe the statistics show similar findings. As of March 2011 the top ten countries in terms of facilities with EMAS certification included Germany (1,898), Spain (1,572), Italy (1,503), Greece (843), Austria (654), Belgium (428), United Kingdom (337), Denmark (248), Portugal (125), and Sweden (76) (European Commission, 2011). The top of the list shows some of the largest economies in Europe, however in this list there are notable omissions of large economies such as France and the Netherlands.

Firms only have an incentive to pay for the implementation of an ISO 14001 or EMAS certification if they perceive the benefits to outweigh the costs. As with many business decisions, a cost benefit analysis is conducted either formally or informally to determine if the cost of implementation and certification provides value. Kollman and Prakash (2002) argued that the uneven distribution of EMS certifications across different countries can be described in terms of supply and demand. The authors explain supply as how information about EMS standards are distributed in a country, and demand as the manner in which firms' stakeholders react to this introduction. This is a broad overview and assumes that adopting an EMS is either affected by an increase or decrease in the supply and demand sides. Supply represents changes in information about the value an EMS can bring as distributed by governments, trade organizations or others. Demand represents the concern of customers or supply lines have for products

produced with environmental impacts taken into consideration during their production.

The demand side, as described by Kollman and Prakash (2002), is driven by customers, stockholders, and public opinion. There have been many studies conducted on the demand side as presented by Kollman and Prakash (2002). One good overview is presented by Watson and Emery (2004) highlighting some of the many reasons companies would look to go above and beyond the regulatory minimum standards to both reduce exposure to future regulations and cater to a more environmentally conscious customer.

The supply side of EMS certification as described by Kollman and Prakash (2002) is driven by the spread of information on the usefulness of an EMS can provide. Information spread on usefulness can be driven by industry groups and from the government. Case studies have been presented looking at motivations of companies that have decided to adopt an EMS. Small scale studies (Fryxell, Lo, & Chung, 2004; Mohammad, 2000; Poksinska, Dahlgaard, & Eklund 2003) and large scale studies (Labonne, 2006; OECD, 2007) attempt to determine what motivations drive the decisions of manufacturing facilities to adopt and implement ISO 14001:2004, EMAS or other standardized EMS and auditing schemes.

This study focuses on government incentives that function on both the supply and the demand aspects of EMS. Government incentives can directly distribute information about the value an EMS can bring to a manufacturing facility. Government incentives can also focus on improving the benefits achieved by a manufacturing facility that has already implemented an EMS. In this study, rewards that governments can provide are split into two groups

providing preference when purchasing goods or services, rewarding implementers with recognition rewards or reduced environmental enforcement.

Impact of Research

What do governments achieve by incentivizing the adoption of EMSs in manufacturing facilities? Environmental regulation is traditionally performed through a combination of incentive based and command and control regulations (Oats, Portney & McGartland 1989). Command and control based environmental regulation sets limits on pollution and has legal consequences when those limits are found to be exceeded. Following a command and control approach to environmental regulation puts a burden on the regulatory authorities that leaves them vulnerable to inconsistent enforcement and a tendency toward inflexibility and over-formality (Webb, 2004). This type of regulation typically prescribes a maximum amount of emission that is allowable and in some cases a technology or piece equipment that should be used (Aidt & Dutta, 2003). Due to the nature of command and control policy needing to prescribe limits on so many different processes and manufacturing sectors the number of laws themselves can become unmanageable by the regulatory authority. "At some point in the escalating process of governments churning out statures, agencies writing regulations, and courts deciding cases, nobody will be able to say anymore what the applicable legal rules really are or what they are accomplishing. When a body of law becomes so complex and arcane that it cannot even be known, let alone fully complied with or enforced, one cannot hope that its objectives will be realized" (Orts, 1995, p. 782).

Incentive based regulation has been introduced, most notably in Europe and the United States, to give other motivations for compliance with

environmentally set limits. This type of regulation typically uses items such as environmental taxes, tradable permits, or other market based options to achieve environmental goals (Aidt & Dutta, 2003). Incentive based regulation has been seen as a good compliment to command and control regulation, but often with unforeseen consequences. This type of regulation can encourage growth of certain industry types and limit the potential growth and expansion of others. An example of this presented by Gurtoo and Antony (2007) shows that government restrictions on the use of hazardous substances in production lines do not always equate to a cleaner production as intended.

Governments and regulatory authorities have realized the complications with the traditional methods of government regulation. There has been a growing trend of environmental policy makers attempting to give flexibility to industry groups and individual companies to reduce their environmental impact using voluntary environmental programs or (VEPs) (Henriques & Sadorsky, 2008; Kollman & Prakash, 2002). If implemented with the proper controls, a higher level of flexibility in environmental regulation could lead to widespread use of VEPs by governments, industry groups, and companies (Henriques & Sadorsky 2008; Paton, 2000).

VEPs in general have been successful in allowing business to address environmental and social problems before politicians or regulators have the time or will to enact legislation. When governmental bodies have not moved to correct visible environmental or social problems through the use of legislation or creation of voluntary programs, companies have acted to respond. Under pressure from the public, industry groups have implemented a version of voluntary or self regulatory programs to fill the void in government regulation in an attempt to

correct environmental or social problems (Bernstein & Cashore, 2007; Ruggie, 2004). The authority filling these voids are non-state market-driven (NSMD) governance systems from which actions are based off of market incentives and not necessarily compliance obligations (Cashore 2002).

An example of a VEP being used to correct a perceived social problem is Fair Trade labelled food. Nongovernmental organizations and companies perceived that farmers in developing countries needed guidance in farming their crops more sustainably and offered to pay them a small premium for them to comply with the Fair Trade standards. Companies that buy the goods can then put the Fair Trade label on their products and potentially charge a premium to socially aware customers, thus a market driven solution without government regulation. There are studies of both positive and negative criticisms of how a program such as Fair Trade labelled food is implemented, but for study here this general principal is suffice. Blowfield and Dolan (2010) provide a more detailed look into the potential advantages and disadvantages of Fair Trade labelled schemes and their affects on achieving their environmental and social goals.

Voluntary environmental programs have started in a number of different ways. According to Morgenstern and Pizer (2007) they can be grouped into three distinct groups: public voluntary programs, negotiated agreements between business and government, or unilateral agreements by industrial firms. These three distinct groups have been implemented in various degrees of success in different industry sectors and in different regions of the world. EMSs are considered unilateral agreements implemented by industrial firms and are the focus of this study.

Environmental auditing and management standards such as ISO 14001 or EMAS provide widely applicable methodologies that work across industry sectors and national regulatory systems. The purpose of these standards is to help account for potential environmental impacts, and to bring these potential impacts into the business decision making process, in line with their established environmental policies. Auditing, either internally or by a third party, judges if the management system in place is adequate to fulfil its intended role.

Many manufacturing facilities operate with an EMS in place but choose not to have it certified (Johnstone, 2007). An uncertified EMS can offer a manufacturing facility many of the same benefits that come from third party certification without having to pay for certified audits to be performed (Darnall & Pavlichev, 2005). However what is lacking from self certified EMSs are independent third party assessments and the threat of loss of certification.

Certification of an EMS can be either a symbol of implementation to satisfy outside customers, corporate headquarters, and regulatory authorities or it can simply signify a change within the facility itself. A recent Brazilian study found that certification of an EMS did tend to motivate the manufacturing facilities that adopted them to achieve self set environmental goals and train workers about potential environmental impacts (Oliveira, Serra, & Salgado, 2010).

As firms export to world markets and become more international the demand side of EMS becomes increasingly homogenized. This makes it difficult to explain why there is such a wide gap in the number of certifications attained from ISO and EMAS across countries. Looking at the EMAS certification statistics presented previously, there are very large notable economies such as France and the Netherlands that have fewer EMAS certifications than countries

like Greece and Portugal. It is clear that the motivations driving companies to seek EMAS certification vary greatly between countries.

The ISO 14001 standard is the dominant EMS in the world in terms of numbers of certifications. Statistics show this international aspect of the standard cannot be assumed to be directly linked to the role of producing or exporting goods and services internationally (Johnstone, 2007). In terms of the value of manufacturing goods and services the United States is the leading manufacturer in the world, however it ranks eighth in the number of ISO 14001:2004 certifications (ISO, 2010). Despite the German manufacturing sector being the most robust in Europe it ranks seventh on the list following four other European countries including Romania (ISO, 2010).

There have been attempts to explain why the certifications of EMSs vary greatly from country to country. With every country having different regulatory methods in place to govern their environment and economy, the numbers of variables are too many to attempt comparisons. Some academic articles have been successful at predicting the adoption rates of the ISO 14001 standard in countries using diffusion models (Marimon, Casadesus, & Heras, 2010; Viadiu, Fa, & Saizarbitoria, 2006). These diffusion models use data from the spread of ISO 9001 standard on quality control and apply it to how quickly the ISO 14001 standard spreads within a country as it becomes more popular. Although this method is successful for a number of countries and shows there is a strong relationship between the motivating factors between the two different standards, it does not look at what these motivations are and how they can be changed. By looking at motivators that manufacturing facilities cite as their reasons for adopting a certified EMS, this study can help policy makers to identify and target

incentives and affect the predictions of adoption in Marimon et al. (2010) and Viadiu et al. (2006).

Government policy makers and environmental regulatory authorities have implemented a series of incentives to help encourage the adoption of certified EMSs by manufacturing facilities. With many government incentives, implementation can result in unintended consequences (Berlin, Bancroft, Card, Lin & Robins, 1998). A study conducted by Henriques and Sadorsky (2008), found when the Canadian government offered technical assistance programs designed to help manufacturers cope with lack of environmental expertise, participants became dependent on the programs and were less likely to take other actions to improve their environmental performance. This example shows that it is important to look closely at how incentives work and if they have the impact they were originally designed to achieve.

This study takes the results from previously conducted surveys and case studies to find which government incentives can be connected to an increase in the number of implemented EMSs. This study also looks to see if there is evidence that incentives can create an increase in the environmental performance of a facility. This combination will give policy makers a framework to begin to consider the effects that incentives can have on regulatory authorities that enforce the regulation, manufacturing firms, and the environmental performance of those manufacturing firms that choose to take advantage of the offered incentives.

As the number of multinational companies continues to grow, coupled with the continuation of free trade deals being negotiated between countries throughout the world, a corporation increasingly has the ability to open new

production facilities where it chooses. With customers, stock holders, and stakeholders stretched across the globe, the demand side of EMS will increasingly become homogenized within industry sectors. This homogenization of the demand side motivators of EMS could mean that the supply side will become increasing important. It is for this reason that this study focuses on what role governments and regulatory authorities play by offering incentives to manufacturers located within their borders. To accomplish this, a review of previously published work on the fundamental benefits that a manufacturing facility can gain from implementing an EMS is reviewed in combination with reasons why governments and regulatory agencies are actively encouraging the adoption of EMSs.

The second area of concentration for this study is a discussion of specific government incentives that countries have used to encourage the adoption of EMSs. This section presents three categories incentives can be grouped into based on fundamental properties of how they work. With the creation of these categories this study looks at the implementation of incentives not only from the perspective of the manufacturing facility, but also the advantages and disadvantages of their implementation from the regulatory authority or government perspective.

The third portion of this study builds support for the categorization of government incentives by taking a critical look at previously conducted case studies and surveys conducted on manufacturing facilities and identifying when the incentives have been effectively implemented. Finally the study draws conclusions about which incentives could be effectively implemented by

governments to increase the adoption of EMSs in their manufacturing sectors as well as attain results to determine if the incentives achieved their goals.

Problem Statement

Governments around the world have chosen to introduce incentives to encourage manufacturing facilities to adopt EMSs with the goal of improving environmental performance. There is a question as to how effective these incentives are at increasing the number of facilities that choose to adopt an EMS. A study is needed to look at the type of government incentives that are currently offered to encourage the adoption of an EMS, discover evidence that if these programs work as intended, and determine if a government can measure if these programs are working as intended.

Objectives

This study identifies government incentives used to encourage the adoption of certified EMSs in manufacturing facilities and compares how efficiently the incentives work. The following objectives were established:

- List the types of potential government incentives that can be used to encourage the adoption of an EMS and group them into three categories: reducing the barriers to EMS adoption, enhancing the benefits derived from EMS adoption, and rewarding EMS implementers with reduced enforcement.
- Critically review each category of incentives that were created, specifically looking at how the incentives have been implemented in countries and if they were seen to be effective in encouraging the adoption of EMSs.

- Determine if there is evidence that the government incentives affect the environmental performance of a manufacturing facility.
- Draw conclusions from the available literature as to which policy tools are most effective in encouraging the adoption and implementation of EMSs in different countries.

Limitations

This research project sought to fulfil the objectives listed above. It was not designed to be an exhaustive study of all countries which have policy instruments to help encourage the adoption or EMSs. As a result, this project had the following limitations:

- Information from case studies and surveys is vast in the academic literature. Although the literature review is comprehensive, it is limited and the findings of this research are drawn from the findings presented in the references section.
- This studies focus was limited to private sector manufacturing facilities.
- The focus of this study concentrated on countries that are already well developed such as OECD countries, or in the process of developing quickly such as Brazil, Malaysia, India, and China.
- This study is based on those case studies, surveys, and literature published in English or translated into English.
- Politics and political environments in countries are not reviewed in depth or applied to the findings from in this study.
- No direct causal and effect relationships can be drawn from government incentives and adoption of an EMS.

Assumptions

Given the objective of working with data from previous published case studies and surveys to determine how government incentives can be used to help encourage the implementation of EMSs, some assumptions have been made during the course of this investigation:

1. Manufacturing facilities with similar products are assumed to have similar processes and potential environmental impacts in the nations where parallels are drawn.
2. Manufacturing facilities are assumed to want to achieve higher efficiency within their means. Facilities that have profits are assumed to want to reinvest those profits into at least partially into achieving efficiencies and achieving environmental compliance.
3. An EMS is considered to be a useful tool in assisting a manufacturing facility in achieving previously undiscovered efficiencies and limiting environmental impacts.
4. EMSs are assumed to have a positive influence on the environmental performance of a facility to some measurable degree.
5. The enforcement of environmental regulations by the government, such as performing inspections are assumed to have a positive influence on the environmental performance of a manufacturing facility.
6. Information and statistics used from other studies are assumed correct and were not independently verified.

7. It is assumed that if a government incentive shows a benefit to a particular type of manufacturing facility it can increase the number of overall EMS certifications for that type of manufacturing facility.

Chapter 2

LITERATURE REVIEW

This portion of the study reviews previously published work from the academic literature to establish the foundation of the discussion. This chapter starts by looking at the evolution of the standardized EMS, then at both the internal and external benefits that these systems have been found to assist in achieving. Finally, in preparation for the discussion, the study reviews some of the reasons why governments want to encourage manufacturing facilities to adopt EMSs.

Brief History of Environmental Management Systems

What is an EMS? The European Commission (n.d.) defines an EMS as "a problem identification and problem solving tool that provides organizations with a method to systematically manage their environmental activities, products and services and helps to achieve their environmental obligations and performance goals." To simplify this even more, an EMS is a management tool used to help negate potential environmental impacts.

By establishing appropriate organizational structures, an EMS is expected to allow companies to promote corporate environmental responsiveness and strive to accomplish environmental goals and targets. Taking the additional step and having the EMS certified to an external standard gives the facility assurance that it operates an EMS that meets a management standard. The motivators that drive companies to seek out the certification of their EMS will be covered more in depth later in this chapter.

Third party certified EMSs evolved over time, however through this evolution their basic purpose has remained the same. Beginning in North America during the 1970's, companies began implementing individual EMSs as a

method to manage the rapid changes of new environmental regulations (Bracke & Albrecht, 2007). Individual management systems were implemented for each facility or perhaps there was some spread of standards within companies or industry groups. These individualized efforts may work effectively in an individual facility or with a specific manufacturing process; however they are individualized to the point where they cannot easily be compared from one facility to another.

After some time there was a desire to standardize the environmental management system and the British Standards Institute (BSI) developed the BS7750 standard which was designed to complement the BS5750 standard of developing, implementing and maintaining a quality management system (McClosky & Maddock 1994). According to Krut and Gleckman (1998) the BS7750 standard was the national standard of Great Britain and was adopted as the environmental management standard of the Netherlands and Denmark, while national standards in France, Ireland and Spain were developed based of BS7750.

With growing support to standardize EMS and auditing systems wider than national standards (Watson & Emery, 2004) the EMAS was passed by the European Council on 29 June 1993 and went into effect on 10 April 1995 for industrial activities. Later in 2001 the law establishing EMAS was repealed and replaced by a very similar regulation expanding eligibility for certification beyond those involved in industrial activities to all organizations. The EMAS standard continues to be updated with the newest version EMAS III which entered into force in 2010. According to EMAS statistics, in March 2011 there were over 7,900 certified sites in 26 countries.

The International Organization for Standardization introduced a standard for EMS in 1996 with its publication of ISO 14001. The number of certifications quickly grew with there being more than 22,000 certifications in 2000 (ISO, 2009). Similar to EMAS, ISO 14001 underwent a revision in 2004. With this change all certified companies had to be in conformance with the updated standard by 2006. Munro and Harral (2005) stated that the ISO 14001:2004 revisions made clarifications to portion of the standard that were thought to be vague in the previous version, particularly in the communications, documentation and competence portions of the standard.

Looking at the top ten countries in certifications of the EMAS standard that were listed in the previous chapter, it is found that there are more ISO 14001:2004 certifications in every country listed with the exception of Greece (ISO, 2009). A good discussion about the motivations for a company to adopt the EMAS standard instead of or in addition to the ISO 14001 standard in European countries is highlighted by Bracke, Verbeke, and Dejonckheere (2008). The ISO 14001 standard has a history in Europe beginning with the BS7750 standard being replaced by ISO 14001 in 1997. The European Commission EMAS website provides guidance to firms that are already ISO 14001 certified looking to achieve EMAS certification (Bracke et al., 2008). This builds on a shared environmental philosophy behind the two standards in which they can work together and not necessarily compete with one another.

With EMAS concentrated on the standardization of EMS in European based companies, ISO 14001 has been focused on a global scale of distribution. The ISO 14001 standard has become the dominate EMS standard in terms of number of certifications. According to ISO (2010) in December of 2009 there

were more than 223,000 ISO 14001:2004 certifications awarded in 159 different countries worldwide. The dominance of this standard across all industry sectors in all regions of the world reinforces the desire of companies to have a dominant standard that could be widely applied as stated by McClosky and Maddock (1994).

Internal Advantages of Environmental Management Systems

What are some determining factors that cause manufacturing facilities to adopt EMSs? This section of the paper reviews some advantages that are internal to manufacturers attributed to the implementation of an EMS.

When a manufacturing facility takes a first look at reducing its environmental impact there are usually a number of actions that are inexpensive to implement resulting in a relatively large improvement in environmental performance (Hart, 1995; Hart & Ahuja, 1996). Individual success stories from companies that have actively reduced their environmental footprint while achieving cost savings are numerous and widely publicized on company websites and press releases. For example, the 3M Corporation began a pollution prevention program in 1975 and reports an avoidance of 2.9 billion pounds of pollutant emissions while saving over $1.2 billion in a 30 year time period (3M Corporation, 2009).

Although immediate cost savings are one factor that comes into consideration when a manufacturing facility is deciding whether to adopt an EMS, future cost savings are also be taken into account. Walker, Pitt, and Thakur (2007) suggested that to measure the full value of EMS cost savings that new methods of accounting should be developed to take into account future costs as well as current or short term costs. Walker et. al. (2007) suggest long term

accounting of environmental impacts play an important role in running a sustainable business, however they also note long term future cost savings coming from the implementation of an EMS are difficult to quantify.

One area where results of EMS implementation are seen in the short term is environmental compliance. One reason manufacturing facilities choose to implement a certified EMS is that managers believe that implementation will assist the facility in achieving compliance with existing environmental regulations (Darnall, 2006). Compliance with environmental regulation and performance of manufacturing facilities within a large corporation have been the focus of corporate managers (Gabel & Sinclair-Desgagne, 1993), and are thought to be a reason why corporations require their manufacturing facilities to implement certified EMSs (Darnall, 2006).

Some manufacturing facilities that are concerned with environmental compliance are not only worried about what regulations currently exist, but also about new environmental regulations that could be imposed in the future. Evidence has been presented showing manufacturing facilities concerned about potential future environmental regulations tend to implement environmental management systems (Khanna & Anton, 2002). Reducing emissions or expanding processes with environmental regulations taken into consideration early in the process can result in manufacturers staying below regulatory thresholds that would cause additional regulations to apply to the facility (Darnall, 2006). Looking beyond individual facilities, there is evidence that manufacturing sectors within a region can be motivated to adopt controls to handle environmental problems before governments can react, thus avoiding the implementation of new environmental regulation (Cashore, 2002).

Manufacturing facilities also adopt EMSs as a way to improve efficiency in the manufacturing process. Through an examination of processes, EMSs can lead to better utilization of inputs, reductions of waste, and reductions in emissions all of which are potential money savers for the facility (Hart, 1995; Hart, Milstein, & Caggiano, 2003). EMSs have also been shown to help streamline the administrative tasks associated with running a facility. In the United Kingdom a large survey of manufacturers showed that facilities that had implemented a certified EMS tended to have higher levels of performance in administrative tasks. These facilities also maintained better records of equipment maintenance and employee training and then used that information when making management decisions resulting in improved environmental performance (Dalhstroem & Skea 2002).

External Advantages Resulting from EMS

Focus on cost saving aspects that can result from the implementation of an EMS are the most obvious effects that come with implementation. However, external advantages have also proven to be valuable to manufacturers. In this section of the literature review, the focus moves to those external factors that can result from the implementation of EMSs in manufacturing facilities.

As discussed in the previous chapter, when industry groups identify environmental problems prior to governments passing environmental regulation (Cashore, 2002) the need for regulation may no longer exist. If industry groups foresee an environmental problem, or are pressured by outside groups such as nongovernmental organizations to take action even if there is no governmental regulation, the manufacturers can influence future regulation (Alberini & Sergerson, 2002). If groups of manufacturers can show that environmental

problems can be solved using methods that they have already put into place, this gives them a competitive advantage over competing manufacturing facilities (Vogel, 2000). As Vogel (2000) explains, automobile manufacturers that produced products that met the stricter California emission regulations in 1989 had a competitive advantage over other manufacturers when the California standard was adopted by the United States federal government in 1990.

Some consumers are demanding more environmental performance from their products (Vogel, 2000; Cashore, 2002; Bernstein & Cashore, 2007). Implementation of EMSs can provide confidence in the product being manufactured. Certification of EMSs are publicized by manufacturers and used as supporting evidence that their products are manufactured with environmental controls in place (Harris, 1996). Certification of an EMS or other environmental certification programs allows manufacturers to distinguish their products from competitors and potentially charge a premium for that product (Nimon & Beghin, 1999). Additional confidence to customers is not only important when manufacturers are producing an end product, but also when they are part of a supply chain. Factories that are located in developing countries far away from the companies they supply are more likely to implement an EMS to give their supply chain more confidence (Johnstone, 2007).

Finally, some manufacturers require that their suppliers have a certified EMS in place. General Motors and the Ford Motor company have required their suppliers to have an ISO 14001 certified EMS in place for nearly a decade (Bansal & Bogner, 2002). As we will discuss more in depth in the next chapter some governments offer preferences to manufacturers that have implemented an EMS when procuring goods and services. Implementing an EMS that meets

requirements set by potential customers allows manufacturing facilities to not be excluded from potential buyers when attempting to sell their goods.

Manufacturing facilities that are a part of a larger corporation have demands placed on them to implement an EMS from corporate offices as well. Investors take environmental considerations into their valuation of public companies and some corporations see a certified EMS as a signal that they are managing their environmental liabilities (Cox & Douthett, 2009).

Government Motivations to Incentivize

Historically countries have taken a strict command and control approach to the enforcement of environmental regulations. For this study, command and control policy is defined as a rigid emission level set by the government with no possibility of modification by regulatory authorities (Oates, Portney, & McGartland, 1989; Webb, 2004). Using this definition most countries use some form of environmental command and control regulation, but it has been more prevalent in countries like the United States, Canada, and Germany and has led to an adversarial relationship between manufacturers and environmental regulatory agencies (Khanna & Anton, 2002; Henriques & Sadorsky 2005; Rennings, Frondel, Horbach, & Requate, 2005). While these countries are well developed and have very stringent environmental regulations in place to protect the environment, command and control techniques have shown some limitations in use.

Command and control legislation can be expensive and take long periods of time to develop, be overly formal and inflexible (Webb 2004), and be vulnerable to inconsistent enforcement due to lack of funding (Davies & Mazurek, 1996). These types of limitations do not provide the flexibility to regulators and

manufacturers to be creative and develop process changes. Manufacturing facilities located in strict command and control environments tend to implement high cost end of pipe pollution controls rather than implement process changes (Coglianese, 2001). Command and control systems also limit the ability of regulators to reward manufacturers that make reductions in emissions below the set government level (O'Ryan & Sanchez, 2007).

Arguments have been made that when governments impose strict environmental regulations, manufacturers must invest significant amounts of both human and financial resources to comply (Jenkins, 1998). This can affect the decisions that management of a manufacturing facility can make on what products should be produced in which facilities. Jaffe et al.(1995), lays out the short term decisions for a manufacturer that is faced with sudden changes to environmental regulation. The manufacturer would have a decreased competitive advantage and potentially would lose market share to global competitors in less regulated areas. This could result moving the production overseas, or stopping production altogether and focus on a product unaffected by the regulation (Jaffe et al., 1995). Any of the three choices would be seen as unfavorable for the manufacturing facility.

When a facility produces pollution that affects the local environment and is governed by the local environmental authorities then manufacturers could relocate and not bother with expensive pollution abatement (McGuire, 1982). Although this scenario is possible, Jaffe et al. (1995) concluded there is no evidence that supports a manufacturer to relocate only for seeking relief of environmental regulations. Environmental regulations are only one factor out of

many determining what manufacturers decide to produce and where they choose to produce it.

The limitations of command and control policies have been known for over a decade by regulators and there has been growing encouragement to get manufacturers involved in VEPs, such as implementing an EMS (Henriques & Sadorsky, 2008; Morgenstern & Pizer 2007; Paton, 2000). Through encouraging the implementation of EMSs, governments and environmental regulators can achieve environmental improvements on top of the prescribed command and control limits on allowable pollution. The incentivizing of EMSs can help the government and regulatory authorities achieve improvements in the environment by rewarding companies that choose to go beyond compliance levels with their emissions. When manufacturers have successful EMSs in place it also gives regulators the ability to focus enforcement efforts on non-EMS implementers, hence saving or concentrating limited resources.

This chapter has established there is strong supporting evidence that EMSs can provide benefits to manufacturing facilities. Motivating factors can result from external forces driven by customers and supply chains or internal forces resulting from a desire to improve environmental performance, achieve environmental compliance, or cut costs of energy usage and waste disposal. Finally it was established that governments implement incentives to encourage manufacturing facilities to implement an EMS.

Although there is also available literature that criticizes the use of EMSs and questions how effective it is at achieving the benefits claimed, this literature is not needed to establish how government incentives can affect the decision of a manufacturing facility to adopt an EMS. Due to the focus of this study, it is only

necessary to look at the beneficial qualities of an EMS to establish the foundation for why governments attempt to incentivize their implementation. In the discussion portion of this study an in depth review of incentives used by governments to encourage the adoption of EMSs in manufacturing facilities is discussed.

Chapter 3

METHODOLOGY

This study takes existing literature on what motivates manufacturing facilities to adopt EMSs and combines it with literature on governmental policies used to encourage manufacturing facilities to adopt an EMS. The focus of this study is to list potential government incentives used to encourage the adoption of an EMS, categorize these incentives in three groups based off of their characteristics, and critically review each incentive category to determine how it motivates different manufacturing facilities.

Target Population

The target population for this study is very wide and focuses on case studies and surveys conducted on manufacturing facilities. The manufacturing facilities come from all industry sectors and range from small and medium enterprise (SME) size of less than 250 employees, to large manufacturers having more than 1,000 employees. Data from OECD surveys were used when possible because they utilized the same questionnaires across multiple countries. Smaller regional or nationwide surveys were used to highlight national differences and were combined with findings from other locations prior to drawing over arching conclusions.

Indicators

Indicators used in the study were:

- Lists and categorization of types of government incentives used to encourage the adoption of EMS.
- Determination of the characteristics of each category of government incentive.

- Conclusions about which type of incentive is most effective for different manufacturers.

List and categorize types of government incentives. To establish a list of government incentives used to encourage the adoption of EMS a literature review was performed. The review encompassed books, journals, and information available on the internet. Categories were established by looking at the actions the government needs to perform to implement the incentive.

Characterize government incentive categories. Each incentive category has several incentive types included. To determine the characteristics of the incentive categories, evidence was taken from the existing literature that included information about government incentives. Specifically the methods used by the governments to enact the incentive and how the incentive rewards the manufacturing facility were used to create the categories.

Effectiveness of incentives. Data from previously conducted case studies and surveys were used to determine which incentive programs are successful at encouraging the implementation of an EMS in a manufacturing facility. There are many motivations for a manufacturing facility to decide to implement an EMS, and it is not assumed there is a direct correlation between adoption of an EMS and a government incentive. Conclusions are drawn from looking at how the government incentive affects a manufacturing facility, then assuming a net benefit can result in higher adoption rates.

Summary

This study lists the types of government incentives that are used to encourage the implementation of an EMS in a manufacturing facility and categorizes them into three categories. These results were then combined with the information from published case studies and surveys conducted on manufacturing facilities to determine which government incentives are most effective for different manufacturing facilities.

Chapter 4

DISCUSSION

This chapter of the study presents the types of government policies and programs that can be implemented to incentivize the voluntary adoption of an EMS. It also seeks to determine how effectively these policies and programs have been implemented and if there are methods that governments can use to measure their effectiveness after they have been implemented. The individual incentive types are presented providing examples from previously conducted surveys and case studies. These details help to determine how the incentives encourage the adoption and implementation of an EMS in a manufacturing facility.

Existing published material that finds direct connections between government incentives and EMS adoption are rare. For this reason three categories were created. Each incentive was categorized based off fundamental characteristics of how it is implemented by a government. Effects the incentive have on motivating a manufacturing facility to adopt an EMS are also presented.

The three categories of incentives are compared by examining government programs that have been implemented and their effects on the environmental performance of the manufacturing facility. A critical review is made of each category and the types of motivations it offers the manufacturing facilities that utilize the incentives to adopt an EMS. Finally the incentives are looked at to determine if their effectiveness on improving EMS adoption or environmental performance can be measured.

In order to complete this study a number of assumptions were made. This discussion assumes that the implementation of an EMS or the enforcement of regulations by the regulatory authority both increase the environmental

performance of a manufacturing facility. Often the magnitude of the impact an EMS or the enforcement of regulations have on the environmental performance of a manufacturing facility is affected by the perceived importance and the effectiveness of implementation (Gabel & Sinclair-Desgagne, 1993; Henriques & Sadorsky, 1996; Mohammed, 2000). Therefore, since this study does not look at individual cases of EMS implementation or enforcement, no assumptions are made on whether environmental enforcement or EMS implementation has a bigger impact on environmental performance of the facility.

It is also assumed that the government or regulatory authorities are interested in manufacturing facilities achieving better environmental performance either through increased enforcement of regulations, or through incentivizing EMSs. Traditional methods of command and control environmental regulation have been shown to be costly to implement (Davies & Mazurek, 1996) and it is assumed that governments and regulators have increasingly chosen to achieve environmental performance improvements through incentivizing EMSs (Webb, 2004).

Looking at the academic literature on government policy and programs used to incentivize the implementation of an EMS, the types of incentives used are presented for this study. Traditionally, the implementation of government incentives were looked at in terms of how much they lowered barriers for adoption or how much they raised potential benefits after implementation (Coglianese, 2001). In this study an additional category was added for those incentives that not only lower the barrier for adoption by the manufacturing facility but also provide the government or regulatory authority a benefit through rewards of reduced or targeted enforcement. Particular focus is given to the incentives

that were direct links between incentive implementation and EMS adoption. The three incentive categories are (a) reduction of barriers to EMS adoption, (b) reduced enforcement of environmental regulations, and (c) enhancement of EMS benefits.

Reducing the Barriers to EMS Adoption

Adopting an EMS can be a daunting task for some manufacturing facilities. There is strong evidence that SMEs are less likely to adopt an EMS due to a lack of available financial and human resources (Labonne, 2006; Oliveira et al., 2010). Governments that want to encourage the adoption of certified EMSs can implement incentives focused on lowering these barriers, making it easier for manufacturers to attain certification.

Studies have been conducted that estimate the cost to implement an EMS and results vary widely. Steger (2000) found that the variations within surveys were due to differences in the perceptions of the respondents. Variations on costs between studies were mostly attributed to differences of what was defined as the cost of implementation (Steger, 2000).

Due to the focus of this study, accurate estimations of the cost to implement an EMS is not needed. Instead, attention should be focused on findings about why the cost variations exist within the results. A study conducted by Darnall and Edwards (2006) in the United States found the average implementation costs ranged from $268 per employee for a publically traded facility to $1,441 per employee for government departments. While it is difficult to justify the difference in dollar amounts presented, Darnall and Edwards (2006) found the major reason for the cost difference was attributed to government

respondents referring to a lack of internal expertise and access to resources to help them with EMS implementation.

With this category of incentives, it is assumed governments are attempting to achieve improved environmental performance where possible. In order to achieve this goal, regulators may require additional resources or risk a decrease to previous levels of regulatory enforcement. This could be a result of the manufacturing facility either achieving higher levels of environmental compliance through better organization that was previously not attained, or going beyond compliance without additional laws or strengthening of enforcement. The incentives in this category help manufacturing facilities implement an EMS by lowering their financial or human resource barriers. The incentives include: providing technical assistance, limiting legal liability, providing financial support, and providing information on the value of an EMS.

Providing Technical Assistance. The initial costs of setting up an EMS can be time intensive and require expertise in developing environmental policies, writing procedures, identifying potential environmental impacts, and creating an inventory of applicable legal and other requirements (Darnall & Edwards, 2006). This can result in the manufacturer needing to hire consultants to help with the initial implementation. Governments incentivize facilities to implement an EMS by offering technical assistance programs that help overcome these hurdles.

The United States Environmental Protection Agency (EPA) implemented EMS technical assistance program that targeted technical assistance programs to help facilities implement an EMS (Coglianese, 2001). As noted by Coglianese (2001), meaningful technical assistance could not be offered to all facilities that wanted to participate due to the lack of human resources at the United States

EPA. Upon completion of the program the industry sector templates were developed and were made public for use for the local government, metal finishing and biosolid sectors (Coglianese, 2001).

The lack of technical expertise is particularly a problem for SME sized facilities that do not have environmental staff. Evidence for this is found in a regional study conducted in Brazil. Oliveira et al. (2010) found that manufacturers did not have the technical expertise to implement an EMS and needed to hire specialists to help with the implementation. This was a major hurdle in their decision process and Oliveira et al. (2010) concluded government incentives were one option that the Brazilian government could offer to help fill this gap.

As mentioned earlier in this section, technical assistance programs could take regulators away from their normal daily activities associated with enforcement of regulations if additional funding is not put toward funding the program. This could be considered as a reduction in enforcement activity if the size of the programs are large and require a lot of staff. No studies were found addressing this issue; however, it is a somthing that should be considered. One alternative suggested in the literature is government agencies choosing to charge a fee for their services. Coglianese (2001) concludes regulators would be able to provide lower cost technical assistance to firms that are seeking to implement an EMS, especially when it comes to identifying legal and other requirements.

Overall, technical assistance programs appear to be in demand by facilities that want to implement an EMS and have limited personnel resources. The success of such programs would also be relatively easy for regulators to

measure. Participants would have to enroll in such a program, and regulators may have to make several visits to facilities to offer technical assistance.

Although there were no studies found on the efficiency of such programs at encouraging the adoption of EMS, this could be measured by governments and regulatory authorities by the number of participants that volunteer to join the program. If demand is too high for the regulatory agency to meet, producing sector specific templates could help interested facilities in attempting to implement an EMS.

Limiting Legal Liability. Performing audits or compliance inspections and then maintaining the records to track performance is something that many EMSs require (Steger, 2000). Being required to keep records that could one day potentially be used in court proceeding to show a record of environmental noncompliance could keep some manufacturing facilities from deciding to implement an EMS.

Limiting the potential negative consequences that can result from these findings is a concern in the United States (Cogliansese and Nash, 2001). Having a paper trail of potential non-compliance issues found by internal audits can be worrisome for manufacturers in litigious systems. Placing limits on what is and is not admissible as evidence may reassure some potential adopters.

One example of this type of policy is in the Oregon revised statutes (ORS, 2009). In this statute environmental audit reports are considered privileged and not be able to be submitted as evidence as long as appropriate efforts to achieve compliance were made (Coglianese, 2001; ORS, 2009). This type of regulation could help ensure that as long as actions are promptly taken to address

environmental noncompliance, there would be no legal liability down side to keeping records on identifying and fixing the problem.

Although there are example of these policies in place, measuring the success of a government policy to limit legal liability associated with record keeping is hard to measure. There are no programs for manufacturing facilities to sign up for, and evidence found of these policies being cited in a court of law would not be a good representation of whether the initial policy had an effect on the decision process to implement an EMS. From the available evidence this study concludes the benefit of this type of policy is that after the legislation is initially passed, it would provide the benefit to the facility choosing to adopt an EMS and have no effect on the regular enforcement duties of the regulatory authorities.

Providing Financial Support. A more straight forward way for governments to assist with overcoming the cost of implementation of an EMS is to offer financial assistance, either directly through grants or indirectly through subsidies or tax credits to help offset the cost of implementation. SMEs are more likely to be financially restrained by many of the aspects of EMS. It has been shown that government run financial support programs can cause an increase in EMS adoption among SME manufacturers (Labonne, 2006). This study of seven OECD countries, including Canada, France, Germany, Hungary, Japan, Norway, and the United States, focused on how the environmental performance of SME sized manufacturers differed from larger manufacturers. Labonne (2006) found that financial constraints affected SME sized manufacturing facilities much more than larger ones. In particular SMEs that were offered financial assistance

programs by the OECD governments had a correlation with EMS adoption. This finding did not hold true with larger facilities (Labonne, 2006)

Governments that do provide financial assistance programs would want to limit or target the amount of financial support provided and attempt to record any measurable gains in the environmental performance. If a government or regulatory agency provides too much assistance it may attract a lot of participants and therefore cost a great deal with questionable improvements in environmental performance. If the financial incentive is too small it may not encourage an increase in the rate of EMS implementation and provide the incentive to facilities that would have implemented an EMS without an incentive (Coglianese, 2001).

EMSs have been shown to be effective in assisting SMEs in developing nations to both comply with environmental regulation and improve environmental performance. A regional study from Brazil (Oliveira, 2010), suggested financial support from the government in terms of loan guarantees and lowering of insurance premiums for implementers would encourage a wider adoption of ISO 14001 and improve environmental performance. In India, a case study concluded that the majority of EMS implementers in the study found the EMS good for helping them comply with existing regulations but did little to encourage the manufacturers to continue the environmental improvements (Qadir & Gorman, 2008). The authors concluded that the Indian government would do better to use funding to strengthen the environmental regulatory system, prior to incentivizing EMSs.

Providing financial support is one government incentive that has strong evidence it affects the EMS adoption rates of manufacturing facilities. However,

results from the case studies and surveys suggest that financial incentives should be targeted toward SME size facilities and only offered in developing countries were the environmental regulatory agency is well established. Providing financial support without proper targeting would result in financial incentives being provided to facilities that would have already implemented an EMS with no incentives.

Providing Information. Providing information about the benefits a facility can achieve by implementing an EMS is one method governments and regulators can use to encourage EMS implementation. Gathering information about the potential benefits a facility can better achieve through the implementation of EMS is one of the first steps a manager would take in the decision process. Funding of academic research, advertising in trade journals, directly contacting the facility in person or providing information over the internet are all methods that governments could take to help accomplish this (Johnstone, Glachant, Serravalle, Riedinger, & Scapecchi, 2007; Labonne, 2006).

Informational campaigns run by the government or regulatory agencies can be implemented at little cost with a limited amount of personnel (Coglianese, 2001). It is for these reasons informational campaigns are one of the most popular incentives used across OECD countries.

In a large scale OECD survey with data from over 4,000 manufacturing facilities in Canada, France, Germany, Hungary, Japan, Norway, and the United States, approximately 65% of respondents knew their government provided this type of incentive (OECD, 2007). Japanese respondents were most likely to identify information as a government incentive with approximately 70% of respondents (Hibiki & Armura, 2005). American and Norwegian respondents

were least likely to identify informational campaigns as an incentive with approximately 50% of respondents making the connection (Darnall & Pavlichev, 2005; Ytterhus, 2005).

Although there is strong evidence that providing information on the benefits of implementing an EMS can be considered an incentive, the effectiveness of these programs in actually increasing adoption rates is questionable. Gathering information about whether a manufacturer should consider implementing an EMS is often the first step in the decision process. Compared with the other steps needed to implement an EMS, it is arguably one of the least costly steps toward implementation. It is thought by some researchers that these programs can only have a limited impact. Coglianese and Nash (2001) suggest that larger firms with personnel dedicated solely to the environmental compliance and performance of the facility are not likely to benefit much at all from this type of program, while targeted campaigns aimed at smaller manufacturers would achieve their higher results. Henriques & Sadorsky (2007) also suggest that informational campaigns should be targeted at smaller manufacturers that have limited human and financial resources.

The same large scale OECD study focused on SMEs cited earlier found a connection between SME sized manufacturing firms that took advantage of governmental run informational incentives and the adoption of certified EMSs (Labonne, 2006). More evidence from the OECD shows that SMEs are more likely to cite information provided by governments as a motivation for implementing an EMS than larger manufacturing facilities (OECD, 2007).

Looking at this evidence that governments providing information on the benefits that can be achieved through EMS implementation do have a

measurable impact on the EMS adoption rate of SME size companies. Due to the nature of providing information in published academic studies or informational flyers there is little chance this incentive could be abused in the same way as financial incentives.

Although large surveys have found a positive correlation between this incentive type and EMS implementation in SME size companies, it would be difficult for a government to measure the effectiveness of this type of incentive if the information is provided to the public. Studies could be conducted on EMS implantation rates before and after informational campaigns are implemented, however studies would be subject to outside variables and potentially produce unreliable results.

Reducing Enforcement

Due to the sheer number of environmental regulations, environmental compliance can be overwhelming for a manufacturing facility with limited expertise (Orts, 1995). Increasingly large numbers of manufacturing facilities have at least one individual responsible for environmental concerns, and larger facilities have assigned environmental departments dedicated to complying with environmental regulation (OECD, 2007). One method governments have used to encourage the adoption of EMS in manufacturing facilities is to offer reductions in enforcement of environmental regulations.

Case studies and surveys from many different countries state that achieving compliance with existing environmental regulations is a reason for adopting and implementing an EMS. Qadir and Gorman (2008) found that in India there was a very low rate of compliance with existing environmental regulations and that certified EMSs such as ISO 14001 helped manufacturing

facilities reach and maintain compliance with environmental regulations. The same reason was cited by manufacturing facilities in Germany, where environmental regulations are numerous and considered to be moderately strict by manufacturers (Frondel, Horback, Rennings, & Requate, 2004).

Implementers of certified EMSs show third party auditors that they have the organizational structure required to reach certification standards. However, not all EMS standards require environmental compliance to become certified. Although EMS standards such as ISO 14001 do not require that a facility be in compliance with all environmental regulations to maintain certification, it does require efforts to be recorded to correct noncompliance after the problem is identified (Qadir & Gorman, 2008).

Compliance with all existing environmental regulations is not required to achieve EMS certification, however EMSs are designed to provide administrative oversight and consider potential environmental impacts when making management or production decisions. This organizational approach to the management of the environment has been shown to ingrain environmental aspects into decision making and improve the environmental compliance of manufacturing facilities in some aspects (Dalhstroem & Skea, 2002; Walker et al., 2007).

As discussed more in depth later in this section, this study finds that the perception a manufacturing facility has of how strict environmental regulation is in a country is related to how valuable these types of environmental incentives are perceived. In the United States, where over 90% of manufacturing facilities perceived they were subjected to stringent or very stringent environmental regulations, this type of incentive was popular (Darnall & Pavlichev, 2005). In

contrast, the same OECD questionnaire presented to Japanese manufacturing facilities reported 65% of the respondents felt the environmental regulations they were subjected to were not stringent. The Japanese manufacturers did not find this type of government incentive as a motivator to adopt an EMS (Hibiki & Arimura, 2005).

With this category of incentive types, governments are exchanging reduced regulation in exchange for a facility implementing an EMS. This type of incentive rewards the facility that implemented the EMS by freeing them of the obligation to comply with normal environmental regulation. It provides an incentive for the regulatory authority to focus environmental enforcement on facilities that do not have an EMS in place. This creates a two tiered approach to environmental regulation with a different set of standards applying to EMS implementers (Speir, 2001).

The most widely known incentive program that rewarded facilities with reduced regulatory enforcement was the United States EPA excellence in leadership program (Project XL). Project XL was run by the United States EPA from 1995 to 2002 and rewarded facilities that consistently complied with or exceeded compliance with environmental regulations (Coglianese, 2001; United States EPA, n.d.). Although this program was found to be successful in rewarding facilities with flexible regulation for developing new techniques to reduce environmental waste or emissions it proved to be expensive and time consuming. Blackman and Mazurak (2001) found that the average cost of negotiating and adjusting environmental regulations amounted to approximately $450,000 per facility. Although the authors of this study found flexible regulation as innovative, based on their findings it was determined to be only practical for

large industrial companies that had financial means and professional expertise to develop the innovations needed to participate in the program (Blackman & Mazurak, 2001).

In some countries such as Japan and the United Kingdom, environmental regulation for facilities is more flexible with each facility, and thus these programs are normal and not seen as incentives (Hibiki & Arimura, 2005; Watson & Emery, 2004). In countries where environmental regulation is seen as adversarial to manufacturing, such as Germany and United States, these programs are in higher demand (Darnall & Pavlichev, 2005; Rennings et al., 2005; Watson & Emery, 2004). This section of the study describes incentives that create a two tiered approach to environmental regulation (Speir, 2001).

Altering Regulatory Thresholds. Regulatory thresholds are set to trigger permit requirements or additional reporting requirements to help minimize environmental impact. An example of an adjustable threshold being used is the air quality regulations in Japan. Although Japan was found to have much sticter air quality requirements than those found in the United States or European Union (OECD, 2002), they offer a flexible approach to regulation and negotiate air discharge contracts with facilities based off their size and their ability to reach lower emissions by applying end of pipe emission controls (Hibiki & Arimura, 2005).

Manufacturers that implement EMSs identify environmental aspects and attempt to reduce their impact on the environment. Scaling back the limits on these thresholds gives regulatory authorities flexibility on a case by case basis to decide if the EMS is effective. Overall, of the OECD (2007) survey of over 4,000 manufacturing facilities in seven countries, this method of government incentive

did not prove to be popular. Although this type of incentive may prove valuable to individual manufacturing facilities, this type of incentive would likely have to be negotiated on a case by case basis. Case studies or surveys focusing on the effectiveness of this type of incentive were not found.

With this study's assumption that the primary role of the regulatory authority in a country is to protect the environment, it would be difficult to predict or measure how this incentive alone could measurably increase the adoption or implementation rate of EMSs. It is assumed that this type of incentive would be rewarded only after a facility has proven the ability to consistently comply with or exceed environmental regulations, and be rewarded on a negotiated or case by case basis.

Expediting or Consolidating Environmental Permits. Obtaining and renewing environmental permits can be a time consuming and potentially expensive process for a manufacturing facility. In the United States, some states have taken environmental permitting as a political issue and made attempts to simplify the permitting process to attract industrial development from neighboring states (Algeo, 1995; Robinson 1999). Although these news articles portray local politicians attempting to entice new manufacturing to come to their community, it demonstrates that changing the permitting process can attract manufacturing facilities.

In Hungary the regulators are given the ability to expedite or consolidate environmental permits if a manufacturing facility has implemented an EMS (Kerkes, Harangozo, Nemeth, & Zsoka, 2005). This reward is widely used and is well know by Hungarian manufacturers. Kerkes et al. (2005) found that 73% or respondents knew of the government programs in place to expedite and

consolidate permits. Although the respondents to this survey cited government incentives as generally not important in their decision to adopt an EMS, it is clear from the response rate that the program is used and could contribute as a motivation to implement an EMS.

With this type of incentive, it is possible to see how environmental regulators can offer wide spread exceptions to normal environmental procedures and still be successful. No further information or studies were found on the Hungarian permit programs; therefore it is difficult to speculate if the program is useful in encouraging the implementation of an EMS.

Governments implementing permitting rewards for EMS implementation may have difficultly determining if the program added to the motivation of a manufacturer to implement an EMS. Although there is evidence that such would be utilized (Kerkes et al., 2005), it is difficult to see how an increase in adoption of EMS could be measured using such a program.

Waiving Regulations. The most extreme version a government or regulatory authority could take is to waive environmental regulations for facilities that have implemented an EMS. Existing academic research shows that employees of facilities that have a certified EMS in place perceive environmental issues as a higher priority than in facilities where no EMS is in place (Perez, Amichai-Hamburger, & Shterental, 2009). This higher level of commitment could indicate that environmental regulations are not as necessary in such facilities.

While it is difficult to understand that governments or regulatory authorities would be willing to allow facilities to begin to self regulate themselves completely, examples of this type of incentive can be found on a more limited scale. Programs that remove existing regulation and replace it with site specific

regulation have been implemented in the United States for pilot programs (Blackman & Mazurek, 2001) and individualized regulatory limits are common practices in countries such as the United Kingdom and Japan (Hibiki & Arimura, 2005; Watson & Emery, 2004). In these examples, governments maintain regulatory control over the facilities; however the facilities are rewarded by negotiating more site specific regulations that apply.

Surveys and case studies show that a major reason why a manufacturing facility adopts an EMS is to achieve environmental compliance (Johnstone, 2007; Qadir & Gorman, 2008; Walker et al., 2007). If portions of that environmental compliance regulation are removed, it could signal to the manufacturers that it is no longer important and that efforts should be focused on other environmental issues.

The findings of this study conclude that this type of incentive has and should be used on a limited and negotiated basis. However, if used selectively to reward EMS implementers by allowing discharge reports to be filed quarterly rather than monthly or by sampling air emissions every two weeks instead of every week, this type of incentive could be responsibly used with limited risk.

Reducing Inspections. An environmental regulatory inspection requires a regulator to inspect a manufacturing facility to determine if the facility is complying with environmental regulations. Having an actual presence in a facility to look at ongoing operations has proven to be effective at helping firms avoid serious environmental violations (Telle, 2009). Rock and Aden (1999) found that the frequency of follow-up inspections on a manufacturing facility were more likely to have an effect on the facilities environmental performance than non-compliance warning letters sent out by the regulatory authorities. Performing

regulatory compliance inspections are a necessary part of having a command and control regulatory system. Inspections have been shown to increase environmental performance of a manufacturing facility (Dalhstroem & Skea, 2002). This evidence supports the case of performing environmental inspections when possible.

Norway is a country where there is evidence that this type of incentive program is used to encourage the adoption of EMSs. The results from an OECD survey showed the Norwegian government programs offering a reduction in inspection frequency were the most popular of the government incentives offered to encourage the implementation of EMS (Ytterhus, 2005). Although the author does not explain why this is, the study does state that the Norwegian government charges manufacturing facilities for the inspections that they perform. This evidence suggest that if an environmental compliance inspection charged the facility for the inspection, then there is a larger motivation for the facility to attempt to avoid the inspection by taking advantage of government incentives and implementing an EMS. Further evidence of regulators charging for environmental inspections in a country other than Norway were not found in the literature review, and therefore cannot support this conclusion.

One comparable aspect between countries is the number of inspections that are performed each year. Looking at 2005 OECD survey data, it was found on average that the United States and Germany had the highest rates of inspection of the seven countries included in the survey (Darnall & Pavlichev, 2005; Rennings et al., 2005). Although the respondents to these surveys reported the highest frequency of environmental compliance inspections,

government programs offering a reduction of inspection frequency were not widely offered in these two countries (OECD, 2007).

Johnstone et al. (2007) looked at the data from the seven OECD countries; including Canada, France, Germany, Hungary, Japan, Norway, and the United States, and found that offering a reduction in inspection frequency had a positive correlation with EMS implementation. The authors also found a positive correlation between facilities that perceived they would be inspected often and the implementation of an EMS. This supports the findings in the previous section stating that a major reason implement an EMS is to comply with existing environmental regulations and avoid potential noncompliance findings.

Even though onsite inspections are shown to be effective, it is not difficult to understand that regulatory inspections are time consuming and expensive. Strict command and control policies run by the United States EPA have been difficult to enforce due to lack of funding for inspections (Davies & Mazurek, 1996). It is possible that regulators under budget constraints could choose to reward manufacturing facilities that have attempted to improve their environmental performance by reducing the frequency of their environmental inspections. Expanding the use of programs that reward the implementation of an EMS by reducing their inspection frequency could also help regulatory authorities act more selectively with the facilities that they choose to inspect or potentially reduce the number of inspections that occur (Speir, 2001).

There is strong evidence to support that governments offering this type of incentive can increase the implementation rates of EMS and potentially free up resources for regulators to focus on facilities without EMSs in place (Johnstone et al., 2007; OECD, 2007). There was also strong evidence showing that

implementing an EMS and regulators performing environmental compliance inspections both have a beneficial value to the environmental performance of a facility (Johnstone et al., 2007).

Although these programs can be popular and increase the number of EMSs implemented, the effectiveness of regulatory authorities offering reduced inspections schedules for firms can be seen as counterproductive. Dalhstroem and Skea (2002) found that, in relation to air emissions, sites with certified EMSs had higher environmental performance in a number of areas. The authors did not find having an EMS would lower the likelihood of suffering from environmental incidents or self reported non-compliance findings.

In conclusion, this study finds that if governments want to offer this method of incentive to encourage the adoption of an EMS, it should be done so carefully and in a targeted fashion. Evidence discovered (Johnstone et al., 2007) shows the perception that environmental inspections will occur have an impact on the environmental performance of a manufacturing facility. Governments that provide this method of incentive to encourage the adoption rates of EMS should attempt to measure the level of environmental performance. This could help to ensure that reducing inspection frequencies do not result in lower environmental performance at the facility.

Enhancement of Benefits

Motivation for a manufacturer to implement an EMS can be driven by customers or supply lines. In this final category, this study reviews the types of incentives governments can offer that help the facility after an EMS has been implemented. The two categories of incentives are offering special recognition or rewards and public procurement preferences.

Manufacturers can be motivated to implement an EMS when their supply chain demands it. General Motors and the Ford Motor Company began to demand that their suppliers implement the ISO 14001 standard in 1999, and declared that all of their suppliers would be ISO 14001 certified by 2003 (Bansal & Bogner, 2002). Darnall (2006) found that demands by supply lines accounted for nearly half of ISO 14001 certifications.

Although this study found no evidence of governments mandating that their suppliers should become EMS certified, government procurement programs that offer preferences to EMS implementers were found to be popular. In the United States and Germany, government procurement programs are popular incentives to implement an EMS (Darnall & Pavlichev, 2005; Rennings, et al., 2005). Labonne (2006) found that SME sized manufacturing companies were more motivated to participate in public procurement programs. The author found that SMEs had on average fewer customers they supplied and therefore were more likely to respond to customer demands.

Another motivation that can encourage firms to implement an EMS is to create confidence in their product. Henriques and Sadorsky (2007) found manufacturing facilities that had customers far away from their facility location were more likely to implement an EMS. The authors concluded that a certified EMS brought a level of confidence to the facilities by demonstrating it operated under international environmental standards. Governments that provide special recognitions or rewards to manufacturing facilities can build confidence in a facility and their product.

In the discussion above this study has presented evidence that governments offer these types of incentives to reward facilities that have chosen

to implement an EMS. With this incentive category the government incentive is only rewarded after the EMS has been implemented. In this category of the study the government has the advantage of being able to implement the program with little additional cost and no need for reductions in environmental regulation enforcement.

Special Recognition or Awards. One factor that manufacturers take into consideration when deciding whether to implement an EMS is public perception. When governments provide special recognition or awards to manufacturing facilities for their efforts in implementing a certified EMS this gives an amplification affect. The usefulness of this type of incentive has been questioned though. Coglianese (2001) suggests that only manufacturers in very competitive sectors may find government awards advantageous in helping them distinguish their products.

Although this is an easy program for governments to put into place, the more the program is implemented, the less effective it may be. If the prize is rewarded too often, then the reward will not hold as much distinction and therefore will not be as coveted by facilities or managers (Coglianese, 2001). Speir (2001) counters this argument stating that the competitive nature of managers and facilities uses these rewards as bragging rights. The author gives credit to managers being recognized for working hard and taking pride in having better environmental performance than similar facilities.

Measuring the effectiveness of this type of incentive could be very difficult for governments to implement. Although some manufacturing facilities may implement an EMS to help build confidence in their product, this study did not

find any evidence that facilities would covet government recognition or rewards enough to motivate EMS adoption.

Public Procurement. Preferential consideration for purchasing goods and services is one way a government can support the voluntary adoption of EMS. This type of incentive program puts the government in the role of the customer, and as highlighted earlier in this section, customer preferences can result in changes in the supply chain. Although governments procure goods and services in many industry sectors, it is hard to think that government procurement could affect all industry sectors. It is therefore somewhat limited in its scope of what manufacturers it would influence.

The United States and Germany both have popular preferential procurement programs in place for manufacturers that have implemented an EMS. According to an OECD survey of manufacturing facilities 86% of respondents in the United States and 92% of respondents in Germany indicated that they knew of preferential procurement programs for EMS implementers (Darnall & Pavlichev, 2005; Rennings et al., 2005). There is significant evidence that this type of government incentive has an encouraging effect on SME size manufacturing facilities to adopt an EMS (Labonne, 2006). This finding did not hold true for having an effect on the EMS adoption rates of larger manufacturers.

As with the other incentive in this category, providing preferences to suppliers that have implemented an EMS can easily be conducted by a government. The cost to implement the program would be negligible and would not have an effect on the budget or staff of existing environmental regulators.

Although there is evidence that this type of program has an effect on the adoption rate of SME sized manufacturers, it is difficult to imagine how the

efficiency of the incentive program could be measured. If local or state governments implemented such a program, suppliers may be located outside of the environmental jurisdiction of the government thus making it harder to monitor any measurable improvements in environmental quality.

It is the conclusion of this study that even though the effectiveness of the incentive cannot be directly measured, there is strong evidence in both the private and public sectors that such programs achieve results. If governments can achieve implementing such programs without increasing the amount spent on the purchasing of goods and services, then this study cannot locate any evidence in the available literature why a government would not want to implement such a program.

Summary of Results

The goal of this chapter was to present the types of government policies and programs that are used to incentivize the adoption or implementation of an EMS in a manufacturing facility. This chapter also identified and described available evidence showing if the incentives met their goals.

To accomplish this, the study outlined three categories of government incentives based off of fundamental characteristics of the policies or programs. Connections were drawn between the similar aspects of incentives that encouraged manufacturing facilities to adopt or implement an EMS.

Finally this chapter looked to determine how governments or regulatory agencies could measure the success of the incentives after they were implemented. The results showed that the three categories of incentives shared characteristics of how the policies and programs worked with varying degrees of success in encouraging the adoption or implementation of an EMS.

The first category highlighted incentives intended to lower the barriers that manufacturers have to overcome to adopt an EMS. In this category four incentives were found and reviewed, a) providing technical assistance, b) limiting legal liability, c) providing financial support and d) providing information on the value of EMSs. This category was found to be particularly useful if the incentives were targeted toward SME sized manufacturing facilities. The mechanisms of the incentives focus on assisting facilities that may want to introduce an EMS but lack the financial resources or expertise to do so. The exception to this finding was programs that attempt to limit legal liability. Although such programs could be focused at particular industry sectors, evidence of this type of implementation was not discovered.

It was found that governments could attain measurable results more easily from programs that provided technical assistance or financial support than the other programs. Due to the nature of facilities needed to enroll in these types of programs, governments could measure directly or request information from the participants. Although results for how effective programs on limiting legal liability or providing information would be harder to attain, these programs would be accessible to large numbers of facilities with minimal effort after the programs were introduced.

The second category of incentives offered reduced enforcement of environmental regulations as a reward for implementing an EMS. The four incentives listed in this category were, a) altering regulatory thresholds, b) expediting or consolidating environmental permits, c) waiving environmental regulations and d) reducing the frequency of environmental compliance inspections. This category was found to be rewarded on a limited basis and

usually only after significant evidence was provided showing that the facility could meet or exceed existing environmental regulation. The exception to this was evidence of wide spread use of expediting or consolidating permits in Hungary. Although this incentive proved popular and was used often by regulators, no evidence was found that it had a measurable effect on increasing the rate of EMS adoption.

In this category there was no distinction between SME sized and larger facilities found in the data. Due to these incentives being negotiated or agreed to only after significant evidence of environmental performance had been proven, Blackman and Mazurak (2002), highlighted that larger facilities may be better options for such programs due to their financial resources and ability to attract personnel with enough expertise to design innovative environmental solutions.

The third category of incentives highlighted government incentives that acted as traditional private market incentives. This category focused on encouraging competition and rewarding EMS implementers by giving them preference. The two incentives listed in this category were, a) providing recognition or rewards and b) providing preference in public procurement.

This category of incentives was found to be attractive to governments as evidence showed the programs can be implemented at very little cost and that there was some effect on the number of SME size firms that choose to adopt an EMS. However this category of incentives was found to be difficult to measure results achieved in increased numbers of EMS adoption or increased environmental performance.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

This study was performed to evaluate the how government incentives encourage the adoption of EMSs in manufacturing facilities. To accomplish this goal, this study met the following objectives: (a) listing and categorizing the types of government incentives; (b) reviewing incentive from each category for effectiveness; (c) determining how each incentive category affects manufacturing facilities, and (d) drawing conclusions as how government incentives should be used to incentivize EMS.

Review of Study Objectives

The results of this objective were presented in Chapter 4 of this study and summarized in this section. The three categories established were (a) reducing barriers to EMS adoption; (b) rewarding EMS implementers with reduced enforcement, and (c) enhancing of benefits derived from EMS. The types of incentives found were placed in the three categories based of their fundamental characteristics of implementation. The types of government incentive identified and then listed in Chapter 4 included (a) technical assistance; (b) limiting legal liability; (c) financial support; (d) information on the value of EMS; (e) waiving regulations; (f) altering regulatory thresholds; (g) expediting or consolidating environmental permits; (h) reducing inspections; (i) special recognition or rewards, and (j) public procurement.

The second objective was to critically review each category of incentives and identify characteristics shared attempt of the incentive types included in each. This objective was met with the summary of results section found at the end of Chapter 4.

The final two objectives of this study were to find if there is conclusive evidence that government incentives can cause an increase in the amount of EMSs adopted and implemented and identify which have been shown to be the most effective. This objective is found throughout Chapter 4 with a concluding discussion found in the remainder of this chapter.

Conclusion Summary

Government incentives do not have to play a role in decision of a manufacturing facility to adopt an EMS. A facility may choose to implement a certified EMS for no reason other than their main customer imposes the demand on their supply chain as General Motors and the Ford Motor company did to their suppliers about a decade ago (Bansal & Bogner, 2002). Another scenario as presented by Speir (2001) was the competition between managers and the seeking of public recognition for their efforts. The motivations that drive a manufacturing facility vary greatly and are too many to attempt to list.

A government may want to encourage the adoption of EMS in the manufacturing facilities to help encourage facilities to strive to reach emission targets below the command and control targets and improve the air quality of the region. Another government with an overstretched and underfunded environmental regulatory authority may want to reward EMS implementers with reduced enforcement so resources can be focused elsewhere. The reasons why a government would want to encourage manufacturing facilities are numerous.

The overlap of these two motivations is the focus of this study. The point at which a government draws the line between encouragement of the private governance and enforcement is difficult to decide. Strong enforcement of

regulations coupled with robust incentives for implementation of EMSs are ideal, but may be difficult to accomplish due to budget or political constraints.

In developing countries where there is a strong demand for EMS participation and certification, some large scale studies have concluded EMSs use the weak government regulations as a starting point and do not strive to achieve large gains in environmental performance (Qadir & Gorman, 2008). Although manufacturers in these countries show a desire to improve environmental performance and receive the recognition that comes with a certified EMS, studies show that giving the facility organizational capacity to comply with existing environmental regulation is still a major motivator for adoption (Oliveira et al., 2010; O'Ryan & Sanchez, 2007; Qadir & Gorman, 2008). In these examples, government resources would do best at first to strengthen regulatory authority rather than spending resources on encouraging EMS adoption.

In developed countries governments have established a strong set of environmental regulations resulting from decades of environmental legislation and enforcement. The effect of strong environmental regulatory authority has helped establish innovative businesses that not only adapt to more stringent environment regulation, but use it to their ability to quickly adapt as a competitive advantage (Jaffe et al., 1995; Vogel, 2000).

It is the opinion of some academic studies that in this type of regulatory environment giving facilities more freedom in the manner which they can attain environmental compliance is a plausible option (Lyon & Maxwell, 2007), due to the regulation in developed countries having become overly complicated and too difficult to navigate (Orts, 1995). Adding more environmental regulation could

likely result in less enforcement and less compliance due to confusion and inability to adapt. It is for this reason that there has been a trend to allow greater flexibility in reaching environmental targets by looking at environmental legislation through a cost benefit analysis (Shapiro, 2006) and allow companies the ability to change processes and techniques to comply with environmental regulations (Coglianese & Lazer, 2003).

Private companies and corporations have realized the benefits of management systems and improved environmental performance result directly or indirectly in payoffs (Khanna, 2001). As reviewed in Chapter 2 of this study, the drive to standardize environmental management practices using techniques of continual review and improvement in quality management came from private companies and manufacturers. Early adopters of certified environmental management systems were commonly companies that already had a good record of environmental performance (Mohammed, 2000).

This causes concern over the effectiveness of EMSs and the effect they have on the performance of a manufacturing facility. Improvements in environmental performance by firms that adopt an EMS could be a matter of self selection. Manufacturing facilities make a commitment to improve their environmental performance first and then choose to adopt an EMS as a step in that process. Speir (2001) presents a good discussion on whether EMSs drive change and environmental improvements, or if they are simply credited with all environmental improvements after their implementations to justify their existence. Dahlstroem and Skea (2002) highlighted how EMSs help manufacturing facilities with administrative tasks and there is evidence that management systems bring institutional changes where evidence of improvement with time since their

introduction can be seen (Johnstone et al., 2007). Although any initial improvements in environmental performance that occur after the implementation of an EMS could be attributed to other factors, there is strong evidence that EMSs have an effect on environmental performance over a longer period of time.

It is the steps taken to keep certification of an EMS that engrains the environmental considerations into the management decisions of the facility. With the implementation of EMSs, facilities showed that even though violations of environmental regulations still occurred at near the same rate as facilities without an EMS in place, the ability to se the infrastructure put in place by the EMS and react to correct the problem was much greater in the facilities with an EMS (Dahlstroem & Skea, 2002). This is advantageous for both manufacturer and regulator.

Environmental regulatory authorities and governments have also realized the advantages of EMSs as well. Choosing to incentivize the implementation of an EMS in a manufacturing facility is a method in which governments and regulators can help reward achievements in environmental performance beyond compliance.

In Chapter 4 this study discussed incentives that lower the barriers to EMS implementation are more likely to affect the adoption rates of SME size manufacturers. These SMEs were also most affected by programs that worked to enhance the benefits of EMS such as public procurement programs as well. Government incentives that rewarded reduced regulatory enforcement were the only incentives shown to have a measurable effect on the adoption rates of larger companies.

Looking at Johnstone et al. (2007) offering government incentives to reduce the frequency of environmental inspections was the most influential government incentive that affected the adoption rates of EMS. However, Johnstone et al. (2007) also found the number of times per year a facility perceived it would be inspected most indicative of EMS adoption.

Compliance with environmental regulations is not only a concern at the facility level but also on the corporate level and has resulted in large manufacturers and corporations demanding EMS certification from their suppliers and their subsidiaries (Darnall, 2006). This example reinforces the findings in developed countries that having a strong regulatory structure in place first will help with having robust involvement in voluntary environmental programs.

The role of governments and regulatory authorities is to decide where to draw the line between incentivizing and adding additional regulation or enforcement. Looking on a regional or larger scale, incentives could result in improvements in overall environmental conditions by taking advantage of the low hanging fruit gains from new EMS implementers. These gains measured against restraining environmental emission limits to equal the amount of reduction should be considered. Changing emission limits too quickly or too often could have a detrimental effect to manufacturers, whereas encouraging investment and innovation through the means of EMS can help create versatile and self correcting manufacturing facilities.

Suggestions for Further Study

The purpose of this study was to examine incentive types and how they motivate manufacturing facilities to adopt and implement an EMS. However, an

in depth examination of how specific existing laws and regulations of a single country could motivate a manufacturing facility would be a valuable study.

This study raised questions on the effect an EMS has on the environmental performance of a facility in the absence of environmental regulations. A study focusing specifically at the rewarding EMS implementers with reduced or relaxed regulation enforcement would provide valuable information to address this question.

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