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ISO 14001: Greening management systems *

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A challenge facing U.S. businesses is maintaining their role as technological and manufacturing leaders while protecting the natural environment in which they operate. Increased costs of maintaining environmental compliance, political pressure, and customer and supplier demand have caused hundreds of companies to reevaluate their traditional manufacturing processes and operations. In doing so, businesses are increasingly adopting the global environmental management system (EMS) standard, ISO 14001, to manage their environmental impacts more effectively and efficiently.

An EMS is a management structure that provides facilities and parent organizations with a framework to minimize their environmental impacts, ensure compliance with environmental laws and regulations, and reduce wasteful uses of natural resources. Facilities that adopt EMSs may be better able to redesign their operating structures, substitute their regulated inputs with unregulated (and perhaps less harmful) ones, eliminate some of their processes and waste streams altogether, modify their supplier relationships, and implement other changes. As a result, these businesses may no longer be governed by a portion (or all) of the U.S. environmental regulatory system or burdened by its associated compliance costs.

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Moreover, facilities that adopt EMSs may better prevent the shifting of environmental impacts from one subsystem to another and can redirect their attention instead to their highest-priority overall effects on the natural environment.

Given the focus of this book, this chapter discusses the effects EMSs have on the operations of manufacturing facilities that adopt them. There are, however, many other results that EMSs may yield for facilities themselves as well as for public welfare, stakeholder involvement, public policy, business interactions with environmental regulators, and other equally important outcomes. In this chapter we describe the activities of three facilities that have adopted ISO 14001 EMSs. These facilities were selected because they bring to the fore many issues that have been widely speculated regarding facilities that adopt ISO 14001 EMSs, and validate as well as dispel some of the rhetoric associated with ISO 14001-certified facilities. The cases are illustrated with examples of how each of the three facilities has changed its operating structures, modified its input usage, and adjusted its supplier and customer relationships as a result of ISO 14001 EMS adoption.

12.1 ISO 14001 environmental management systems and the National Database for Environmental Management Systems

While many companies have employed EMSs for years, in 1996 the International Organization for Standardization (ISO) created a standardized model for them which was designated ISO 14001. Facilities that wish to adopt ISO 14001 EMSs must consider their environmental impacts and aspects systematically and include five broad components (Figure 1): an environmental policy, an environmental plan, an implementation strategy, monitoring and corrective-action procedures, and management review. ISO 14001-certified facilities are accredited by independent third-party registrars as adhering to the standard's provisions.

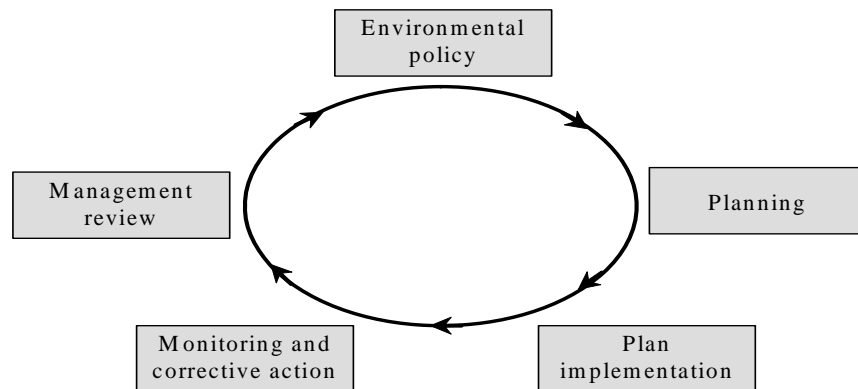


Figure 1: *ISO 14001 Environmental Management System Loop*

During the development of the ISO 14001 standard, many U.S. environmental regulatory agencies became interested in the standard's potential relevance to environmental protection. This interest prompted regulators in a number of states to form the Multi-State Working Group on Environmental Management Systems (MSWG), and in 1997 the U.S. Environmental Protection Agency (EPA) agreed to support a multi-state study in cooperation with the MSWG to determine how ISO 14001-based EMSs affect the environmental and economic performance of facilities that adopt them. Ten states provided technical assistance, financial grants, enhanced publicity, and regulatory flexibility in various forms to approximately 60 pilot facilities that are adopting ISO 14001-based EMSs. In exchange, the pilot facilities have agreed to provide data on their environmental and economic performance prior to and after adopting their EMS, as well as information on their EMS design processes, to the National Database on Environmental Management Systems (NDEMS)¹. NDEMS is a collaborative research effort of the University of North Carolina at Chapel Hill and the Environmental Law Institute in cooperation with the EPA, MSWG, and participating state agencies and facilities.

A subset of the pilot facilities also agreed to provide in-depth case study information on their rationales for adopting their ISO 14001-based EMS, the EMS adoption process itself, and the benefits and costs of EMS adoption. Each case study was performed in-person and at the facility. Key participants were interviewed who were involved in the facility's EMS design process, as were site executives, to obtain detailed information that is otherwise difficult to elicit in surveys or telephone interviews.

The development of both the case studies and the database offers an unusual opportunity for researchers, the business community, and others to study the EMS implementation process and to identify the effects of EMS adoption on facility performance. Both the case studies and the database also provide information on how ISO 14001-based EMSs affect facilities' manufacturing and operations.

12.2 Adopting ISO 14001: three case studies

Presented here are NDEMS case studies of three manufacturing facilities and the effects their ISO 14001 EMSs have had on their manufacturing and operations. All facility names have been changed to protect their identity and will be referred to as Delta Electronics, Alpha Manufacturing, and Epsilon Systems. These cases shed light on the ISO 14001 EMS adoption experience, the types of facilities that adopt them, and the reasons for EMS certification.

Delta Electronics is the first case facility. What is distinctive about Delta is that it has had in place an EMS for nearly 25 years. Then in 1996, after weighing its options, Delta decided to

¹ All information about the database may be found on the Internet at the NDEMS homepage at <http://ndems.cas.unc.edu>. This site includes the NDEMS research protocols, periodic public reports, and other papers, as well guidance and policy documents. The database itself also is available at this site.

certify its EMS to ISO 14001. Delta is what some may argue to be the stereotypical ISO 14001-adopting facility, because it is quite large and is part of a multinational corporation with many resources available to it. Also, Delta has sought for many years to manage its environmental impacts proactively.

Alpha Manufacturing is an interesting second case because it illustrates a non-typical ISO-adopting facility. Alpha is a small, single-facility manufacturing firm that is family-owned and operated. Because of its size, it has limited resources and yet still decided that the potential benefits of adopting ISO 14001 exceeded the costs.

The third case facility is Epsilon Systems. Epsilon's characteristics bridge the differences between Delta and Alpha in that it is a small manufacturing facility with a variety of resource constraints but also part of a larger division within a major international multi-product corporation. Epsilon's primary decision to certify its EMS to ISO 14001 came about because the facility anticipated that in the near future its purchasers would require ISO 14001 certification.

12.2.1 Case study 1: Delta Electronics

Delta is a large electronics facility with nearly four million square feet of operations, approximately 200 departments, and over 8,000 employees. The facility has been in operation for over 30 years and is part of a large multi-national corporation. What is particularly interesting about the Delta case is that prior to adopting ISO 14001, Delta had maintained an EMS for more than 25 years. Unlike its original EMS, which was mandated by its parent corporation, Delta's motivation to certify its EMS in 1996 to the ISO 14001 standard was an internal facility-level decision. Its primary reason for adopting ISO 14001, and for doing so prior to any corporate directive, was that Delta managers believed that certification would benefit the facility at the manufacturing and operational level by better integrating its EMS throughout its entire operating structure and creating more manufacturing and operational efficiencies. In achieving its goal, Delta integrated ISO 14001 into its existing ISO 9001 management system so that environmental responsibility became a component of its product quality. Within one year of adopting ISO 14001, Delta's parent company instituted a policy that required all its facilities to seek ISO 14001 certification.

Delta's decision to adopt ISO 14001 was also influenced by its investments in research and development and innovative technologies, although less directly. For years, Delta managers have considered environmentally conscious manufacturing principles in the facility's product design process. These early investments in "green" operations made it easier for Delta to move forward with ISO 14001 adoption, as many of its managers and employees were familiar with the objectives articulated in the ISO 14001 standard.

While pressures from the public, suppliers, state regulators, or customers are often cited in the literature as reasons why a facility might certify its EMS, Delta reports that it did not experience pressure from any of these sources. Delta did speculate, however, that in the future some of these factors might play a greater role in its ability to do business in the global economy, and EMS certification might serve as a means to better legitimate its proactive environmental leadership philosophy. Closer to home, Delta believed that certification might further enhance its image of

being a responsible neighbor and community member, and one of the state's environmentally conscious business leaders.

12.2.2 Case study 2: Alpha Manufacturing

Once the ISO 14001 standard was formalized in 1996, many of its critics suggested that EMS certification would most likely be limited to larger facilities, inasmuch as smaller facilities tend to have fewer resources to devote to such a procedure and less access to information networks. The case of Alpha Manufacturing challenges this argument. Alpha is a small, privately owned manufacturing facility with less than 100 employees. Compared to Delta and Epsilon's parent companies, Alpha is a relatively young firm that has been in operation for approximately 10 years.

Alpha is a Tier I supplier (supplying complete systems or subassemblies) to the automotive industry as well as a supplier to the appliance and tooling industries. In 1996, the facility certified its newly developed EMS, six months after certifying its quality management system to both Quality System Requirements QS-9000 and ISO 9001. Like Delta, Alpha integrated its 14001 EMS into its quality management system, thus making the facility's environmental goals a component of its quality-focused production.

Alpha adopted its ISO 14001 EMS for several reasons. First, in the early 1980s, the facility had a serious compliance problem that cost it approximately 20% of its annual gross revenues to remedy. This crisis, coupled with the facility's strong presence in the community, prompted Alpha to elevate its environmental performance to a level of priority that exceeded its environmental regulatory requirements, and to move Alpha toward a "beyond compliance" mode of operation.

Alpha's decision to adopt an ISO 14001 EMS was also influenced by a previously experience with its customers' supply-chain requirements. In the early to mid-1990s, Alpha's ability to market its products was constrained by its failure to adopt ISO 9000 and QS 9000. As a Tier I supplier to the automotive industry, when General Motors, Ford Motor Company, and Daimler Chrysler mandated that all their suppliers be ISO 9000 and QS 9000 certified, Alpha was pressed to certify its facility so as to maintain its customer base. When deciding whether to make the investment to certify its quality management system, Alpha managers thought it wise to certify its EMS as well, as a precautionary measure in the event that in the future its customers might also mandate ISO 14001 certification.

Finally, while Alpha does not invest in internal research and development, for a small company, it invests generously in staying informed of the state of the art both within its manufacturing area as well as in other manufacturing industries. The year prior to the finalization of the ISO 14001 international standard, Alpha managers made site visits to European firms that had certified their EMSs to the European Union's Eco-Management and Auditing Scheme (EMAS). They also consulted with an ISO 14001 expert to learn more about how the ISO 14001 standard was evolving, and to determine whether such a system would benefit Alpha. Based on what they heard, the facility's compliance history, and its experience with ISO 9001, Alpha adopted an EMS and certified it to ISO 14001.

12.2.3 Case study 3: Epsilon Systems

Epsilon Systems is a facility whose characteristics bridge the differences between Alpha and Delta. Epsilon is a small manufacturing facility with just over 50 employees, and like Alpha, its smaller structure brings with it a variety of resource constraints that other smaller facilities share. It is also a Tier I supplier to the automotive industry. Unlike Alpha, however, Epsilon acted early to have its quality management system certified and as a result, benefited from its “preferred supplier” status.

Epsilon is also similar to Delta in that it is part of a larger products group within a major international multi-product corporation. As a result, Epsilon is supported by a larger organizational infrastructure, which was particularly beneficial when designing and implementing its EMS. Like Delta, Epsilon certified its EMS to the ISO 14001 standard prior to corporate mandate, although today its parent company requires that all its facilities achieve ISO 14001 certification.

Epsilon has had an EMS since 1993. In 1998, the facility certified its EMS because Epsilon expected increased customer demands to do business with ISO 14001-certified facilities. After discussions in 1996 with General Motors, Ford Motor Company, and Daimler Chrysler, Epsilon managers speculated that future auto makers’ mandates for ISO 14001 certified suppliers were highly likely. Epsilon’s speculation was fortified both by the auto makers’ early 1990 mandates that all their suppliers be ISO 9001 certified, as well as by the benefits Epsilon reaped after implementing its quality system implementation. Epsilon hoped that upon certifying its EMS, it would receive similar benefits and resource savings. As such, Epsilon moved to certify its EMS prior to any industry mandate. Then after achieving ISO 14001 certification, Epsilon used its certification in a campaign to encourage the “Big Three” U.S. auto makers to require that all Tier I suppliers be ISO 14001 certified, thus providing Epsilon an advantage over its non-certified competitors.

An additional reason why Epsilon decided to certify its EMS was related to its parent company’s effort in 1993 to prepare an application for the Malcolm Baldrige Award. As part of this effort, Epsilon and its sister facilities put in place a corporate-designed EMS. Utilizing the formal EMS structure helped Epsilon managers realize that the ISO 14001 framework may further assist the facility in evaluating its environmental aspects and impacts at the site level, and that certification might give Epsilon legitimacy for its EMS. This legitimacy, Epsilon hoped, would translate into a valuable marketing tool and a means to distinguish itself and its corporation from their competitors.

Epsilon’s decision to adopt ISO 14001 contrasts with Delta and Alpha in that the facility was not directly motivated by regulatory compliance issues or community concerns. Indirectly, however, Epsilon was affected by one of its sister facilities, which experienced compliance problems and caused all facilities within Epsilon’s division to reconsider their environmental management practices.

12.3 Internal results of ISO 14001 adoption

Prior to adopting ISO 14001, all three case facilities participated in various voluntary pollution prevention programs. This historical context is important because some environmental groups and regulators have suggested that facilities which certify their EMSs to ISO 14001 are merely doing so to obtain third party legitimacy for environmental activities that they would have done anyway. This section provides evidence that contradicts this suggestion. Indeed, all three case facilities have used ISO 14001's structure to critically evaluate their environmental impacts, broaden their environmental focus, and minimize their overall impact on the natural environment.

12.3.1 Increased employee involvement

Internally, perhaps the most compelling result of ISO 14001 adoption for Delta, Alpha, and Epsilon is that no longer are environmental issues considered solely the responsibility of an isolated environmental, health, and safety staff. Today, environmental management activities—from aluminum can recycling, to office paper recycling, to operational efficiency—are now a responsibility of everyone, from secretaries to senior management. For Delta, such an outcome is particularly interesting, especially considering the maturity of both its preexisting EMS and environmental policy, which have been in place since the 1970s. Delta's previous history illustrates that having an environmental management program or policy does not necessarily translate into improved employee understanding of environmental issues. Prior to adopting ISO 14001, for example, approximately two Delta managers knew where to find the facility's environmental policy. Today, most of its 8,000 employees know where the policy is located, what it is, and how their actions contribute to the facility's ability to achieve its environmental goals.

For all three facilities, improved awareness helped them to integrate ownership of their facilities' environmental performance into their staffs' day-to-day business procedures. As a result, environmental goals have been personalized for many employees and have increased their morale and their shared support for the facility's overall business goals.

In involving their employees, Delta and Epsilon rely on EMS improvement suggestions from both their managerial and non-managerial staff. Alpha, however, has limited non-managerial employee involvement and only managers are involved in identifying ways to improve the facility's environmental operations. This difference may be due to the maturity of Delta and Epsilon's EMSs, as much of their "low-hanging fruit" has long since been picked. Similarly, as Alpha's EMS evolves, opportunities for obvious environmental improvements may diminish, and the need for greater employee involvement will become a more important factor in its ability to continually improve its EMS. The difference may also be related to Delta and Epsilon's corporate culture, which embraces employee involvement in their management systems. In contrast, Alpha's corporate culture is one with limited employee involvement, which may be an impediment to Alpha's ability to continually improve its EMS over time.

12.3.2 Improved document control

During various EMS-related conferences and NDEMS meetings, many facility managers have reported that ISO 14001's extensive documentation requirements are the most important reason

why they do not certify their EMSs. Ironically, however, all three of the case facilities report that while documenting their EMS procedures to comply with the ISO 14001 standard was indeed arduous, they reaped significant benefits from it.

All three facilities attribute their increased understanding of how they impact the natural environment primarily to the documentation requirements of the standard itself. Although Epsilon had an EMS in place prior to adopting ISO 14001, it was the documentation requirements of ISO 14001 that caused the facility to systematically analyze some of its environmental impacts for the first time. One outcome of its analysis, for example, was that the facility began to consider its impacts related to using various product inputs.

At Alpha, managers found the aspect- and impact-identification process particularly valuable. In it, they considered for the first time how Alpha's auxiliary operations and supply chain affect the natural environment. As a result, Alpha has asked its suppliers to reduce their chemical use. Moreover, Alpha requires that all its suppliers provide the facility with a written certification of their compliance with all environmental regulations, and have begun to visit their suppliers and audit their operations and procedures.

12.3.3 Improved manufacturing efficiency

Environmental improvements are often credited with improving manufacturing efficiency. For each of the three cases this is also true. An important point worth noting, however, is that in each case efficiency improvements are largely attributed to the focus of ISO 14001 on continual improvement rather than to impact identification or any other specific component of the ISO 14001 procedure. For Delta, increased efficiency was gained by better calibrating its production tank levels and gauges, thereby minimizing its chemical and water usage. While Delta had always regulated its operational devices, incorporating the calibration process into the more structured framework of ISO 14001 improved Delta's control of them.

Alpha's manufacturing efficiency has also improved, largely due to its weekly managers meetings which focus on continual improvement to the facility's manufacturing efficiency. During its meetings, for instance, facility managers became aware of and targeted the large amount of water Alpha discharged and identified ways in which it could be minimized. Since then, a 5,000-gallon tank was installed and water that was otherwise discharged is now collected in the tank and reused in Alpha's manufacturing processes, thus reducing its water bill by 40%. In assessing the facility's manufacturing efficiency and product quality, Alpha managers also identified the impacts of some of its process chemicals on the environment on its workers' health. Today, Alpha has automated one of its process lines to produce a higher quality product while at the same time removing the need for human intervention, and reducing the potential risks and impacts of harmful spills.

At Epsilon, similar events have occurred. Tasked with fulfilling the facility's ISO 14001 objectives and targets, Epsilon's environmental improvement teams have instituted a number of manufacturing process improvements, the most significant being that it now reuses one of its process waste chemicals to pretreat the facility's wastewater. And, as part of Epsilon's continual-improvement focus, environmental impacts are routinely assessed during Epsilon's process reviews. Moreover, when new process lines are developed, Epsilon engineers include design for

the environment (DfE) principles in their overall process design criteria. As a result, Epsilon is now able to manufacture its products more efficiently by reducing its use of chemicals, electricity, and water.

12.3.4 Increased focus on unregulated impacts

It is often suggested that facilities which adopt EMSs have the potential to broaden their environmental focus and consider unregulated as well as regulated impacts. All three facilities' ISO 14001 EMSs have done this, although it appears that the maturity of a facility's EMS may play a part in the extent to which unregulated impacts are considered. Delta, in particular, rigorously assessed its unregulated impacts in part because it had focused for so long on its compliance with environmental laws, and thus naturally progressed towards more actively considering its unregulated ones as well. Specifically, Delta focused attention on its impacts on land use, transportation, and energy use. These issues may not all affect Delta's bottom line significantly, but the facility chose to evaluate them in part because its managers believe that they are an important component of Delta's environmental responsibility. The results include:

- Increased wildlife habitat and open space, by removing unused buildings and parking lots and revegetating unutilized land
- Increased employee use of public transportation (by 36%), by offering a rideshare program, carpooling incentives, and free passes for county transit and light-rail
- Reduced energy consumption (by over 4% each year), by retrofitting energy conservation technology and promoting efficient energy use. Delta also began co-generating its energy, and thus negotiates lower electricity rates from its local utilities.

Alpha and Epsilon have also begun to reduce their unregulated environmental impacts, although not to the degree that Delta has. In addition to reducing its water consumption, for example, Alpha has decreased its electric consumption by 20% by installing energy-efficient lighting and compressors. Similarly, Epsilon has begun to consider its electricity and water use as impacts for attention.

12.4 External results of ISO 14001 adoption

In addition to their internal benefits from adopting ISO 14001 EMSs, all three case facilities have also reaped varying amounts of external benefits, including improved vendor contracts, customer satisfaction, and marketing. For both Alpha and Epsilon, the hope of external benefits of certifying their EMSs played a strong role in their decisions to adopt ISO 14001 in the first place. Some Alpha managers have been disappointed by the slow pace at which they have realized such benefits, but these same managers note that the internal benefits by themselves have turned out to justify Alpha's certification. In contrast, Delta was largely driven to certify its EMS because of anticipated internal benefits, and external factors played little part. Since adopting ISO 14001, however, Delta's external operations have also benefited greatly.

12.4.1 Improved vendor contracts

Both Alpha and Delta recognized while documenting their internal operations that their ability to operate in an environmentally conscious manner relied in part on their vendors' procedures and processes. As a result, both facilities broadened their environmental focus to include their vendors' impacts as well as their own. Alpha, for example, evaluates its vendors' environmental impacts from a regulatory perspective and requires that they provide the facility with a written certification of their compliance with all environmental regulations.

Similarly, Delta evaluates its vendor operations prior to any contractual agreement with them. For example, Delta required its on-site cafeteria, which is contracted out for operation, to institute glass and plastic recycling. These activities, while may seem tangential to Delta's overall goal to manufacture electronic components, further impress upon its employees and the community how every aspect of the facility's operations affects the environment. Moreover, recycling programs such as this one have helped the facility to recycle over 72% of its solid waste each year.

To date, Epsilon has not considered its vendors' operations as a component of its ISO 14001 EMS. One might surmise that Epsilon is thus missing an opportunity to further minimize its environmental impacts, but this finding also illustrates that EMS implementation can legitimately vary both across facilities and in scope.

12.4.2 Improved customer satisfaction

When ISO 14001 was first finalized, there was much speculation about how the standard would affect customer relationships. For all three case facilities, certifying their EMSs to ISO 14001 has translated into improved customer satisfaction. As Tier I suppliers to the U.S. automotive manufacturers, both Alpha and Epsilon enjoy the advantages of being "first movers," certified before the auto makers actually required it.² Both facilities have a very real opportunity to receive greater purchasing preference than do non-ISO 14001-certified firms, thus fortifying their market positions. This opportunity exists in part because of the time necessary to adopt an EMS: once a facility decides to adopt an ISO 14001 EMS, it can take as much as 18 months to 2 years to receive certification. In the short term, Alpha and Epsilon may thus benefit from their ISO 14001 EMSs while their competitors rush to get their EMSs in designed, implemented, and certified.

While Delta adopted ISO 14001 for other reasons, customer demand is now a factor that the facility considers as well. Especially in Western Europe, Delta's large corporate buyers are increasingly requesting that the facility provide them with documentation of its environmental policy and its aspects and impacts. These customers recognize that even ISO 14001-certified facilities may have EMSs that vary in quality and scope, and they are therefore scrutinizing the *content* of their suppliers' EMSs and not merely whether or not a facility is certified.

² General Motors and Ford Motor Company announced in late 1999 and early 2000, respectively, that they will require all their suppliers to be ISO 14001-certified. General Motors requires that its suppliers receive ISO 14001 certified by December 2002 and Ford requires supplier certification by July 2003.

12.4.3 Improved marketing

It is often suggested that firms that adopt ISO 14001 may reap benefits by increasing their ability to market their products. Both Delta and Epsilon would likely agree. Alpha, however, is more reserved. These differences may exist in part because of Alpha's small size, which unlike Epsilon is coupled with limited marketing resources. Indeed, almost all of Alpha's business is due to word of mouth rather than a formalized marketing strategy. Alpha also reports that many of its customers in the appliance and tooling industry do not yet understand the concept of an ISO 14001 EMS, and thus do not place much value on it. No doubt, increased understanding will occur over time as more information about the standard is available and as more facilities certify their EMSs. For now, however, Alpha is challenged with marketing its certification in such a way as to add value to its products.

In contrast, Delta has vigorously marketed its ISO 14001 certification and strong environmental leadership as selling points for its products, and as means to differentiate its products from its competitors. As a component of this strategy, Delta has applied for and received five eco-label certifications for its products. These labels have better enabled Delta to increase its recognition for being an environmental leader, especially within the European Union, which requires eco-labels for all products sold within its boundaries. Outside of Europe, these labels also help Delta by differentiating its products from its competitors'.

Similarly, Epsilon believes that its ISO 14001 certification may increase its ability to market itself as an environmentally conscious producer. Epsilon hopes to benefit by reinforcing its customer relationships and its place as a preferred supplier. Already, these customer relationships are bearing fruit and increasing Epsilon's visibility as an environmental leader.

12.4.4 Regulatory benefits

Both Delta and Epsilon are quick to point out that they did not certify their EMSs in the hope that it would bear any regulatory benefits. Alpha, however, held hope of receiving reduced state monitoring and surveillance requirements for ISO-certified facilities. While these benefits may occur in the future, Alpha has been disappointed that so far they have not transpired.

Despite Alpha's disappointment, all three facilities report that ISO 14001 certification has reduced the time burdens of their compliance-audit procedures by approximately one-third, due to the improvements in the facilities' documentation since adopting ISO 14001. Today, when state auditors perform their compliance audits, these facilities are able to quickly gather all the required information, promptly answer auditor questions, and expedite the audit process.

Ironically, Epsilon has received the benefits which Alpha had hoped to reap. The state environmental regulatory agency now "fast tracks" Epsilon's permit applications and modifications because the facility is recognized by the state as being an outstanding environmental performer. Whether this preference is due to Epsilon's ISO 14001 certification or its general image of being an environmental leader is uncertain as the two are deeply intertwined.

12.5 Summary of Results

Despite the differences among the three facilities, the outcomes of EMS adoption are remarkably similar, as noted in Table 1. There are of course different degrees to which each facility has benefited by the various categories of internal and external benefits, as discussed earlier. Nonetheless, all three facilities have increased their employee involvement in environmental management, improved document control and manufacturing efficiency, and increased their focus on non-regulated impacts. Interestingly, the external outcomes due to ISO 14001 adoption have varied more widely across the case facilities, but include improved vendor contracts, increased customer satisfaction, increased ability to market products domestically, increased access to international markets, and some regulatory benefits.

<i>Results of ISO 14001 Adoption</i>	<i>Facility Name</i>		
	Delta	Alpha	Epsilon
Internal Results			
Employee involvement in environmental management	X	X	X
Increased document control	X	X	X
Improved manufacturing efficiency	X	X	X
Increased focus on non-regulated impacts	X	X	X
External Results			
Improved vendor contracts	X	X	--
Increased customer satisfaction	X	X	X
Increased ability to market products domestically	X	X	X
Increased ability to access international markets	X	--	X
Regulatory benefits	--	--	X

Table 12.1: *Summarized results of ISO 14001 adoption*

12.6 Conclusions

The increasing rate of adoption of ISO 14001 EMSs is an important phenomenon in itself, and for the businesses that choose to implement them. Among the many recent initiatives toward “voluntary approaches” to better environmental management, the adoption of ISO 14001 EMSs represents the most significant form to date of a systematic commitment to continuous improvement in environmental performance by a growing number of facilities and their parent organizations. The results of the three case facilities exemplify this notion, as each of them reports significant improvements in their operating and manufacturing procedures after adopting ISO 14001. This is true even for Delta and Epsilon, which had mature EMSs in place prior to certifying them to ISO 14001. The operating and manufacturing improvements include:

- Increased employee involvement
- Increased document control

- Improved operational control
- Improved calibration and retooling
- Increased process automation
- Increased reuse of chemicals and water in production cycles
- Increased focus on non-regulated impacts
- Increased focus on supply chain impacts
- Increased focus on vendor impacts

The benefits of certification have occurred in part because all three facilities used ISO 14001's procedure to critically evaluate their environmental impacts, broaden their environmental focus, and minimize their overall effect on the natural environment. All three facilities report that employee involvement has been a critical component of their success, particularly in cases where mature EMSs were already in place and fewer opportunities thus seemed to exist to improve the management system further. Smaller facilities like Alpha, with limited resources and information networks, may perhaps experience fewer external benefits of certifying to ISO 14001, but even Alpha is quick to note that the internal benefits alone justify its ISO 14001 certification.

There are no guarantees that the favorable results discussed in these three case facilities will occur across all facilities which certify their EMSs, much less that they will occur systematically across business sectors. Nor is there clear evidence as to the stability of ISO 14001 EMSs over time, especially as personnel committed to them change, and facilities themselves undergo changes in leadership, priorities, financial and market pressures, and even corporate structure and ownership.

However, these cases offer at least suggestive indications that real environmental benefits can occur for facilities that adopt ISO 14001 EMSs. They also illustrate how ISO 14001-certified facilities may benefit from related non-environmental achievements such as increased legitimacy, improved customer satisfaction and marketing, increased document and operational control, and improved operational efficiency.