



An Investigation into Perception of Cost-benefit Analysis  
in Implementing ISO 14000

By

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A Thesis Submitted in Partial Fulfillment  
of the Requirements for the Degree of

Master of Business Administration

Graduate School of Business  
Assumption University  
Bangkok Thailand

June, 2001



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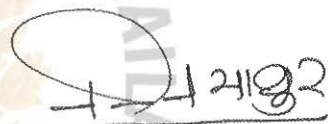
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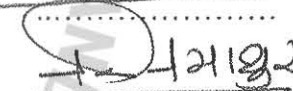
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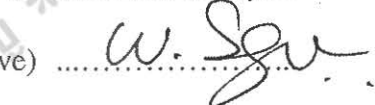
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# Abstract

Environmental Management System has become one of the basic means of competition in Thailand. Companies realize the importance of becoming ISO 14000 certified. More and more companies are going for ISO 14000 certification. Thus, implementing ISO 14000 becomes an important topic. Cost and benefit factors can help the company to understand the way to achieving ISO 14000 certification. The objectives of this study are : (1) to investigate perception of cost-benefit for each activity that relate to ISO14000 implementation; (2) to analyze the perception of costs and benefits relationship when implementing ISO 14000.

Literature is reviewed on general background of ISO 14000 EMS, the situation for implementing ISO 14001 standard in Thailand, what ISO 14000 sery is, benefits of ISO 14000 implementation, cost involved, cost-benefit analysis, competitive advantage, potential costs and benefits of an EMS.

This research formulates a conceptual framework to assess the perception of cost-benefit analysis in implementing ISO 14000 certification. In the framework, dependent variable is measured by benefits, which occur in each activity and costs, which occur in each activity as independent variables. There are nine hypotheses.

The mail survey is conducted among 61 ISO 14000 certified companies in the electronic industry in Thailand according to TISI (Thailand Industrial Standard Institute)--- electronics industry is chosen for this largest population of characterize industry certified companies. Of this forty-three questionnaires accounting for 70.49% response rate are returned. The data analysis methods include descriptive analysis and inferential statistics. The descriptive analysis indicated the average score of both costs and benefits. The result shows that the perceptions of benefits received in implementing ISO 14000 certification have higher average score than costs incurred. Inferential statistics tests in the form of bivariate correlation analysis are conducted with the Pearson correlation coefficient to evaluate the relationship between cost-benefit analysis in implementing ISO 14000 certification.

The result of testing in the relationship hypothesis found that there are positive relationship between costs of ISO 14000 implementation and benefits due to ISO 14000 in management system, technology development, procurement, operations, inbound logistics, outbound logistics, marketing and sales, and services activities. In addition, one hypothesis in human resource management activity has the negative relationship.

Finally, the recommendations are made to the result recommendation, general recommendation, and recommendation for further research.



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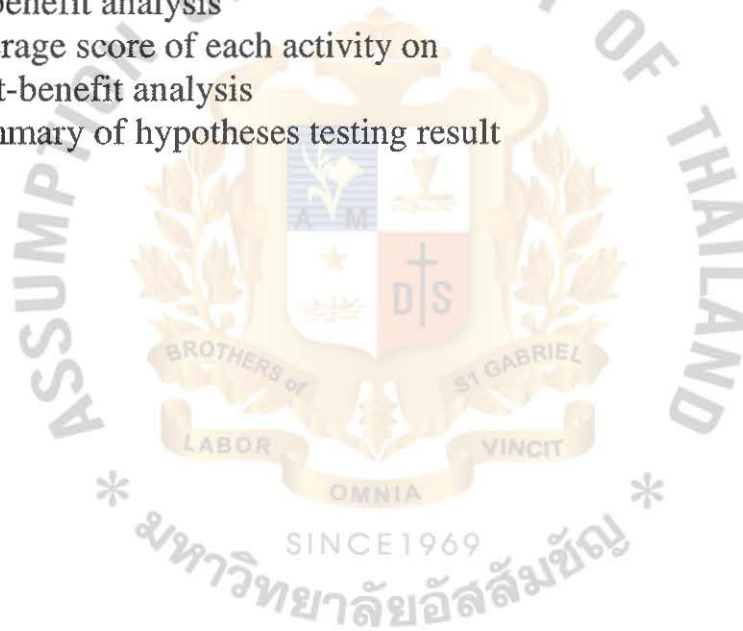
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# Chapter 1

## Introduction

With the increasing concern about maintaining and improving the quality of the environment and protecting human health, the environmental performance of an organization is of increasing importance to internal and external parties (Terasart,1999). An environmental management system(EMS) is a systematic approach to continuously improve environmental performance. ISO14001 is such a standard, which specifies the requirements of an environmental management system. This is because of fierce competition and high pressure from consumer markets in terms of environmental consciousness, and increased recognition of environmental protection. It is also a voluntary standard that lay out the procedures for making any size or type of company more environmentally friendly(Source:<http://www.tisi.go.th>).

This new set of international standards is expected to become available to help businesses around the world to respect the environment, while at the same time enhancing international trade and the competitiveness of participating organizations (Balikov,1997).

The ISO14001 Environmental Management System standard was introduced to Thai industry beginning in 1996. The Thai Industrial Standards Institute, Thailand Environment Institute, and Thailand Productivity Institute have since been instrumental in promoting adoption of the standard(Terasart,1999). Over the past four years, the number of industries applying for achieving the certification has continuously increased. But the number of certified organizations(about 302 as of December 3, 2000) is still low compared to the number of manufacturing facilities that emit pollution and misuse natural resources(Source : <http://www.tisi.go.th>). To reach the vast majority of organizations in Thailand and successfully convince them to adopt this environmental management system, it is necessary to identify the relationship between cost and benefit each activity to find internal benefits of company by identifying electronic industry which have already ISO14001 certified (Smith,1997).

Many companies had still thought the outside benefits from environmental projects more than those inside. As it is clear from the results of this study, large benefits can be received through implementing EMS(Sri-Amorntham,1997). Some of these benefits can be quantified, such as reduced consumption of energy, the savings due to recycling and selling of by-products, but there are also various non-quantitative benefits like positively enhanced public image, better relationships with public authorities and as an increase of labor loyalty, all of which a company can not affordable to neglect(Ritchie and Hays,1998). These kinds of benefits should be clearly recognized, especially in companies that have not decided yet in ISO 14000 implementation in order to help a company to make correct decisions about its strategies from an environmental point of view.



The electronic industry is the most interesting than other industries because the largest number of certified companies belong to this sector(Krasachol,1998). The electronic industry in Thailand is an important sector in the present day economy, producing products that make up the core of the enormous and still growing information industry. The rapid expansion of the manufacturing and service sectors in Thailand is generating strong demand for electronics equipment. The highest value is for personnel computers. Production of computers is mainly for export, where the product has to compete with products from neighbor countries. Therefore the quality of the products is obviously becoming importance. Companies are paying more and more attention to ISO14001 certification(Humphries and Sheets,1989).

Implementing ISO14000 is getting more and more attention. The benefits of ISO14000 certification successfully and effectively become an important topic, which can stimulate the company implementing ISO14000.

## **Statement of problem**

The rate of ISO14000 certification has not been growing rapidly as it should be especially, when comparing to economic growth in Thailand. Despite the benefits of implementing ISO14000, many Thai companies are not going for ISO14000. These companies are unaware that they can be profited not only in creating a better image of the company but also in efficiency of internal operations in the company.

1. What are the costs and benefits of each activity in electronic industry in implementing ISO14001 certification?
2. Are there benefits received higher than incurred costs in each activity in ISO14000 implementation?

## **Objective of the study**

This study is expected to benefit companies, which are interested to become certified and also knowledge and understanding these cost-benefit factors will assist the firm which have not achieved ISO 14000 to find clearly advantages in successfully registering ISO14000. This research will identify what the costs and benefits are of each activity in electronic industry and there are higher benefits received than incurred costs for each activity in ISO14000 implementation.

**The specific objectives of the study are as follows:**

1. To investigate perception of cost-benefit for each activity that relate to ISO14000 implementation.
2. To analyze the perception of incurred costs and benefits received when implementing ISO14000.

## Scope of study

Generally, ISO14000 implementation not only includes ISO14000 certification but also maintenance and continuous improvement of quality system after certification. The interest of this research is when companies decided implementation ISO14000 till had gotten the certification of ISO14000.

1. The scope of the study is limited to the companies in electronic industry in Thailand that have already registered ISO 9000 first and then have been certified ISO14001.
2. The research is limited to only the sample population those are aware of the ISO14000 standard and those who have implemented ISO14000 management systems.
3. The list of electronic industry are updated the information for public on December 3, 2000.
4. There are many various researchers on the cost- benefit obtained from ISO14000 implementation. However, this study focuses on the framework suggested by Porter's Model.

## Importance of the study

There must concerns in environmental protection and the introduction of ISO14000 EMS, many manufacturers are facing a decision problem on whether they should implement the ISO14000 EMS. They hesitate because they do not have a clear picture of the costs and benefits that would be brought to them by adopting ISO14000 (Chin, 1998).

This study is expected to benefit companies which are interested to implement ISO14000 in the future and try to transfer more information to some companies which have not decided for ISO14000 implementation yet. This thesis can benefit for other followers to guide them further research in modern business survival and it will contribute to Thailand's future on economic growth and development.



# Structure of the Study

The structure of the study is described by figure 1-1 shows the complete design of how the research is carried out.



Figure 1-1 Structure of the Study

## Definition of term

Some concepts are different from those used in other research; therefore, they are defined for purpose of this study as following:

Certification :	The procedure by which third party gives written assurance that a product, process, or service conforms to specific requirement.
Environment :	Surroundings in which an organization operates, including air, water, land, natural resources, humans, and their interrelation(Note— Surroundings in this context extend from within an organization to the global system.)
Environmental aspect :	Element of an organization's activities, products, or services that can interact with the environment (note : a significant environmental aspect is an environmental aspect that has or can have a significant environmental impact.)
Environmental impact :	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products, or services.
Environmental management system :	That part of the overall management system that includes organizational structure, planning activities, responsibilities, practice, procedures, process, and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy.
Organization :	Company, corporation, firm, enterprise, authority, or institution, or part or combination, whether incorporated or not, public or private, that has its own functions and administration (note: for organizations with more than one operating unit, a single operating unit may be defined as an organization.)
Registration :	The procedure by which an organization indicates relevant characteristic of a product, process or service or particulars of an organization or person and then includes or registers the product, process, or service in an appropriate publicly available list.



System :	A collection of operations that perform a desired function.
Benefit public relations :	Enhance competitiveness and gain or retain customers for the company's products.
Technical committee 207 (TC207) :	The committee, and its sub-committees include representatives from industry, standards organizations, government and environmental organizations from many countries for international environmental management standards.
Primary activities :	The activities involved in the physical creation of the product and its sale and transfer to the buyer as well as after-sale assistance.
Support activities :	To support primary activities and each other by providing purchased inputs, technology, human resources, and various firmware functions.
Cost :	Costs involved in participating in ISO 14001, costs for consultants and for obtaining certification, costs arise in connection with analysis, documentation and auditing of the EMS and the training of employees.
Benefit :	Internal benefits and external benefits. internal benefits include reduced liability, increase efficiency/reduced costs, improved environmental performance, and external benefits are improved public image, enhance customer trust and others.
ISO14000 :	A set of international standards for improving the environmental performance of organizations.

# Chapter 2

## Literature Review

*At first, people refuse to believe that a strange new thing can be done, and then they begin to hope it can be done, then they see it can be done-then it is done and all the world wonders why it was not done centuries ago.*

*Frances Hodgson Burnett,  
the Secret Garden.*

### The Growing in Environmental Management System

In the globalization world, the environmental issues seem to be one of the most important topics. The pollution created in any manner such as air emission, effluent, land contamination, etc., have several impacts to people throughout the world(Wolfe, 1997).

The environmental trends that have gathered momentum for the past 30 years cannot be stopped, and they should not be ignored. They are growing. Eventually, their influence will touch every corner of the global business community.

An environmental management system is well-documented and structured approach to coping with regulations and customer requirements related to environmental issues. This has sensitized both workers and industry. As of 1995, the governments of the United Kingdom, Germany, Norway, and the Netherlands will do business only with suppliers that have environmental management system. The U.S. Department of Energy is also beginning to require an environmental management system for its suppliers. Just about any company faces a growing number of environmentally related regulations. With world trade increasing, the environmental concerns of other countries are being passed from international corporations down through their supplier network. More and more companies are being required to provide environmental impact information for their products. Faced with this deluge of requirements, the typical company needs to organize its resources effectively to face this challenge. It is a common charge that too much environmental regulation can actually force companies out of a market or completely out of business. In turn, it is the companies that best plan and prepare for such regulations that survive and prosper (Clement, 1996).

### What are standards?

Standards are documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of



characteristics, to ensure those materials, products, processes and services are fit for their purpose.

The existence of non-harmonized standards for similar technologies in different countries or regions can contribute to so-called "technical barriers to trade". Export-minded industries have long sensed the need to agree on world standards to help rationalize the international trading process. This was the origin of the establishment of ISO (Clements, 1996).

ISO (International Organization for Standardization) is a worldwide federation of national standards bodies, at present comprising 127 members, one in each country. The object of ISO is to promote the development of standardization and related activities in the world with a view to facilitating international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity. The results of ISO technical work are published as *International Standards*.

International Standards thus contribute to making life simpler, and to increasing the reliability and effectiveness of the goods and services we use (Source: [www.iso.com](http://www.iso.com)). Upon this pressure, the International Organization for standardization has developed the environmental management standards which is known as the "ISO 14000 Series"

ISO 14000 is a set of international standards for improving the environmental performance of organizations. It includes the new standard for environmental management systems (EMS) called ISO 14001. This standard was published October 1, 1996, so it is new on the international scene.

Users have more confidence in products and services that conform to International Standards. Assurance of conformity can be provided by manufacturers' declarations, or by audits carried out by independent bodies.

**ISO standards are developed according to the following principles**  
(Source: [www.quality.co.uk](http://www.quality.co.uk)) :

- **Consensus**  
The views of all interests are taken into account: manufacturers, vendors and users, consumer groups, testing laboratories, governments, engineering professions and research organizations.
- **Industry-wide**  
Global solutions to satisfy industries and customers worldwide.
- **Voluntary**  
International standardization is market-driven and therefore based on voluntary involvement of all interests in the market-place.

## Background

Organizations are becoming increasingly concerned with the potential impact of their activities, processes, products and services on the environment. They face increasing pressure, both internal and external, to alter their business management plans to give environmental protection greater priority (Clements, 1996). Organizations' efforts to address environmental concerns can be given more order and consistency through the implementation of an environmental management system (EMS). An EMS provides the framework for organizations to examine issues such as the allocation of resources, assignment of responsibilities and on-going evaluation of practices and performance (Terasart, 1999).

## International Developments

Development in the area of EMS started in the early 1990s. In 1992, the British Standard BS 7750 was introduced. This standard was subsequently revised in 1994. While the British Standard was being developed, work on the European Commission's environmental standard for companies began. This work eventually led to the launch of the Eco-Management and Audit Scheme (EMAS) in 1993. Revisions to these two standards has made them very similar in their requirements (Source: <http://www.tisi.go.th>).

Countries around the world, following the lead set by the British Standards Institute, started developing EMS standards. Standards organizations in Australia, Canada, France, Ireland and South Africa published EMS standards which very closely followed the provisions of BS 7750 and EMAS. In 1993, the International Organization for Standardization (ISO) established a Technical Committee (TC 207) to develop and produce a set of unified, voluntary standards for environmental management. This action was based on the advice of the Strategic Advisory Group on the Environment (SAGE), which was set up to examine the need for standardization of environmental management practices (Source: <http://www.quality.co.uk>).

TC 207 held its first plenary meeting in Toronto in June 1993. The second meeting was held in Australia in May 1994 and the third in Oslo in June 1995. To date, a number of countries have already adopted the ISO 14001 EMS standard as their national standard. Countries that have already adopted the ISO standard includes Austria, Australia, India, France, Malaysia, New Zealand, Switzerland, Thailand, Turkey and the U.S.

After the last TC 207 meeting, two committee-draft (CD) standards on Environmental Management Systems and another three on Environmental Auditing were evaluated to Draft International Standards (DIS), with the view of having the final publication of the ISO standards in 1996. There was also general consensus that the ISO EMS standard should be used as the "single world-wide EMS standard for self-declaration and specification purposes" (Terasart, 1999).



# Developments in Thailand

## *Current State of Thai Industry and Environment*

Economic growth was driven by substantial expansion of both domestic and export markets. Review of industrial growth indicates the majority of increased GNP can be attributed to the rapidly expanding industrial sector. Together, the high growth activity of the manufacturing sector has put a severe strain on Thailand's infrastructure and resources, and raised increasing concerns about environmental problems related to the generation, treatment and/or disposal of hazardous waste, toxic waste, untreated or poorly treated industrial wastewater, solid industrial waste, and air pollution generated by industrial activities(Rungrotsakorn,1998).

As Thai business is currently more likely to adopt EMS rather than Institute a cleaner production program, this description will focus only on the current status on the ISO 14000 series of standards in Thailand(Terasart,1999).

## **The Situation for Implementing ISO 14001 Standard in Thailand**

Thailand has made certain important steps toward environmental protection, such as the early phase-out of CFCs, an ambitious reforestation program, and eco-labeling. On the eco-labeling front, ten product categories have been approved, and technical committees are working to establish criteria for evaluating products. A public-education campaign is in the works(Sirichokchaikul,1996).

In the Thai consumer market, environmental friendly goods have already appeared, often with strong promotional campaigns. Energy-saving light bulbs, refrigerators and appliances are common (Bangkok Post, Sep. 11<sup>th</sup>,1995).

The Thailand Industrial Standards Institute (TISI), the country's national standards body, which introduced Thailand to the ISO 9000 standards in October 1991, has been trying to educate exporters as the first channel for introducing Thailand individual companies to the ISO 14000 standard in 1995(Sirichokchaikul,1996). In addition, TISI and other organizations, such as the Industrial Estate Authority of Thailand (IEAT) and Thailand Environment Institute (TEI), have invited expertise from the US and UK to conduct seminars for the introduction and promotion of ISO 14001 standard.

Even with clear progress in moving toward ISO 14001, its implementation in Thailand might not be so easy. Thai industrialists have been slow in preparing for ISO 14001. Most companies, especially local companies, either take a "wait-and-see" benefits or have no interest at all in complying with the environmental management system(Wungwongvirod,1997).

## What is ISO 14000 series?

The ISO (International Organization for Standardization) is a worldwide federation of national standards bodies, comprising members from 127 countries (Fredericks, 1996). The object of the organization is to promote the development of standardization and related activities throughout the world, with a view to facilitating the international exchange of goods and services and the development of cooperation in the spheres of intellectual, scientific, technological and economic activity (Cascio, 1994).

In the globalization world, the environmental issues seem to be one of the most important topics. The pollution created in any manner such as air emission, effluent, land contamination, etc., have several impacts to people throughout the world (Ritchie and Hays, 1998). Upon this pressure, the International Organization for Standardization has developed the environmental management standards which is known as the **"ISO 14000 Series"**.

ISO 14000 Series is the set of standards relating to environmental management system. The structure of the standards is as follows:  
(Source: Thai industrial standards institute, 1996).

- Environmental Management Systems (EMS)
- Environmental Auditing and Related Environmental Investigations (EA)
- Environmental Labeling (EL)
- Environmental Performance Evaluation (EPE)
- Life Cycle Assessment (LCA)
- Terms and Definitions (T&D)

Generally, the standard used for certification is ISO 14001 Environmental Management Systems - Specifications with Guidance for Use.

## What does the ISO 14000 Series cover ?

The best way to answer this question is to provide a list of the ISO 14000 series of environments standards:



Table 2-1 : The ISO14000 Series (ISO14000,2000)  
 (Source : <http://www.quality.co.uk/eco/isolist.html>)

Standard	Title / Description
14000	Guide to Environmental Management Principles, Systems and Supporting Techniques
14001	Environmental Management Systems - Specification with Guidance for Use
14010	Guidelines for Environmental Auditing - General Principles of Environmental Auditing
14011	Guidelines for Environmental Auditing - Audit Procedures-Part 1: Auditing of Environmental Management Systems
14012	Guidelines for Environmental Auditing - Qualification Criteria for Environmental Auditors
14013/15	Guidelines for Environmental Auditing - Audit Programs, Reviews & Assessments
14020/23	Environmental Labeling
14024	Environmental Labeling - Practitioner Programs - Guiding Principles, Practices and Certification Procedures of Multiple Criteria Programs
14031/32	Guidelines on Environmental Performance Evaluation
14040/43	Life Cycle Assessment General Principles and Practices
14050	Glossary
14060	Guide for the Inclusion of Environmental Aspects in Product Standards

# Environment Management System Requirements

The EMS model (Figure 2-1) follows the basic view of an organization, which subscribes to the following requirements:

## Environmental management system model

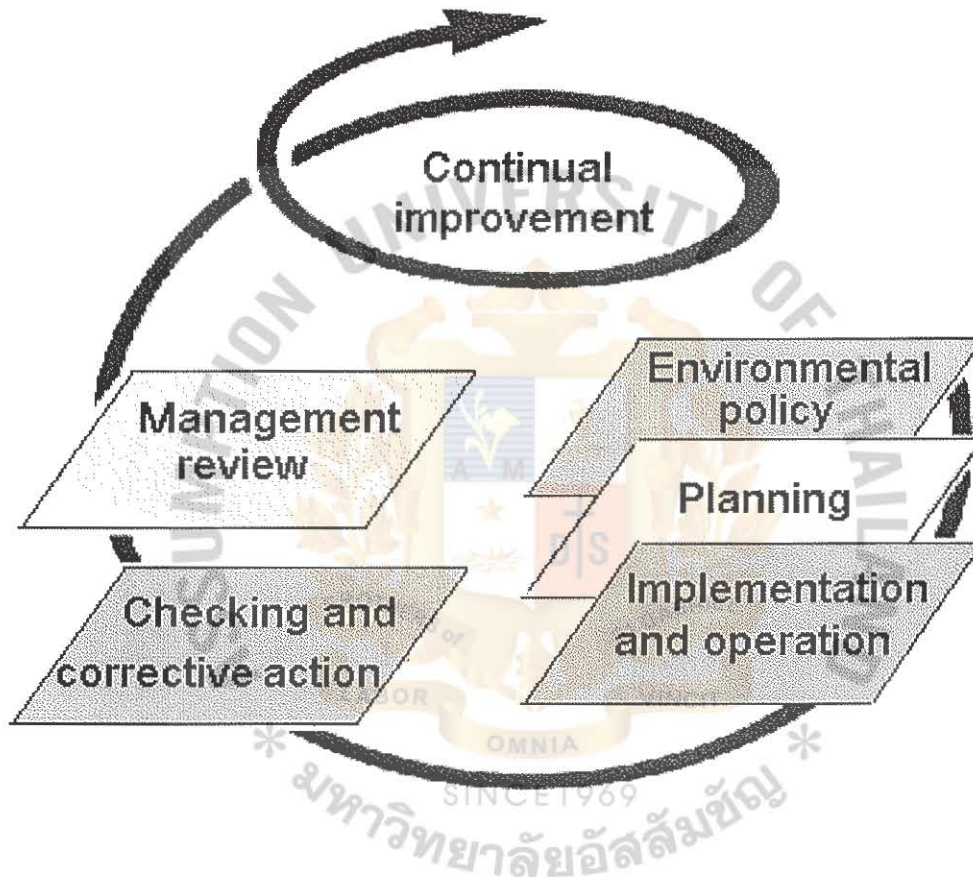


Figure 2-1 ISO14001 Environment Management System Model.  
(Source : Thai Industrial Standards Institute(TISI), ISO14001)

### 1. Environmental policy

Top management shall define the organization's environmental policy and ensure that it

- is appropriate to the nature, scale and environment impacts of its activities, products and services;
- includes a commitment to continual improvement and prevention of pollution;



- c) includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes;
- d) provide the framework for setting and reviewing environmental objectives and targets;
- e) is documented, implemented and maintained and communicated to all employees; and
- f) is available to the public.

ISO14001 requires an Environmental Policy to be in existence within the organization, fully supported by senior management, and outlining the policies of the company, not only to the staff but to the public(Fredericks,1995). The policy needs to clarify compliance with Environmental Legislation that may effect the organization and stress a commitment to continuous improvement. Emphasis has been placed on policy as this provides the direction for the remainder of the Management System (Homison,1996).

Those companies who have witnessed ISO9000 Assessments will know that the policy is frequently discussed during the assessment, many staff are asked if they understand or are aware of the policy, and any problems associated with the policy are seldom serious. The Environmental Policy is different, this provides the initial foundation and direction for the Management System and will be more stringently reviewed than a similar ISO9000 policy(Hussey,1996). The statement must be publicized in non-technical language so that it can be understood by the majority of readers. It should relate to the sites within the organization encompassed by the Management System, it should provide an overview of the company's activities on the site and a description of those activities. A clear picture of the company's operations.

## 2. Planning

To fulfill its environmental policy, an organization should formulate a plan. The following EMS elements should be included in the plan:  
(Source:Thai industrial standards institute(TISI),1996).

- Identification of the organization's activities' products or services which have an effect on the environmental and carry out an evaluation of their associated environmental impacts.
- Establish and maintain procedures to identify legal requirements, which are directly related to the organization's activities, products and services.
- In the event that external standards are non-existent or not meet the requirements of the organization, internal performance criteria should be developed and implemented.
- Environmental objectives and targets should be formulated. The objectives and targets form the goals of environmental performance for the organization to attain.
- Establish programs to achieve the objectives and targets.

The preparatory review and definition of the organization's environmental effects is not part of a ISO14001 Assessment, however examination of this data will provide an

external audit with a wealth of information on the methods adopted by the company (Lamprecht,1997). The preparatory review itself should be comprehensive in consideration of input processes and output at the site. This review should be designed to identify all relevant environmental aspects that may arise from existence on the site. These may relate to current operations, they may relate to future, perhaps even unplanned future activities, and they will certainly relate to the activities performed on site in the past (i.e. contamination of land).

The initial or preparatory review will also include a wide-ranging consideration of the legislation which may effect the site, whether it is currently being complied with, and perhaps even whether copies of the legislation are available(Rahmat,1998). Many of the environmental assessments undertaken already have highlighted that companies are often unaware of all of the legislation that affects them, and being unaware, are often not meeting the requirements of that legislation.

The company will declare its primary environmental objectives, those that can have most environmental impact. In order to gain most benefit these will become the primary areas of consideration.

### **3. Implementation**

To ensure successful implementation of its environmental policy and the ability to achieve the environment objectives and targets, the capabilities and support mechanisms in the organization must be identified(Terasart,1999).

#### *Structure, Responsibility, and Training*

In the implementation of the EMS. The organization must define and make available appropriate resources (human, physical, and financial) To be effective in managing the EMS. The system must be aligned and integrated with existing management elements. There should also be accountability. The personnel responsible for the overall effectiveness and implementation of the EMS must be clearly defined. Ensure all concerned staff are competent and aware through training and communication. As previously mentioned, top management's commitment to the EMS is important. They can demonstrate their commitment by a key role in explaining the organization's environmental values to the staffs. This also helps in awareness building within the organization.

#### *Operational Control*

Organizations must identify risks due to accidents and emergencies in its operations and stipulate who has control and responsibility for them.

#### *Emergency Preparedness and Response*

The organization must identify risks due to accidents and emergencies in its operations and stipulate who is responsible for prevention and mitigation.



#### **4. Monitoring and Measurement**

An organization must monitor and measure its performance periodically. This includes reviewing data for corrective action and improvement.

##### *Records*

Records are evidence of ongoing operation of the EMS and are therefore vital. The records should be maintained with specific retention time and disposal procedures.

##### *EMS Audits*

Audits should be conducted periodically to determine whether the system conforms to planned and has been properly implemented and maintained.

#### **5. Review and Improvement**

An organization should review and continually improve its environment system, with the objective of improving its overall environment performance. The review of the EMS is necessary to ensure its continuing suitability and effectiveness. The concept of continual improvement is the foundation of an EMS(Roger,1997). It is achieved by continually evaluating the environmental performance of the EMS against environment policies, objectives and targets for the purpose of identifying opportunities for improvement.

### **Why have these new standards ?**

A set of international standards brings a world-wide focus to the environment, encouraging a cleaner, safer, healthier world for us all. The existence of the standards allows organizations to focus environmental efforts against an internationally accepted criteria(Ritchie and Hays,1998).

At present many countries and regional groupings are generating their own requirements for environmental issues, and these vary between the groups. A single standard will ensure that there are no conflicts between regional interpretations of good environmental practice.

The fact that companies may need environmental management certification to compete in the global marketplace could easily overshadow all ethical reasons for environmental management. Within Europe, many organizations gained ISO9000 Registration primarily to meet growing demands from customers. ISO 9000 quality registration has become necessary to do business in many areas of commerce. Similarly, the ISO 14000 management system registration may become the primary requirement for doing business in many regions or industries(Fredericks,1995).

The standards apply to all types and sizes of organizations and are designed to encompass diverse geographical, cultural and social conditions(Diamond,1996). For ISO14001, the standard does not establish absolute requirements for environmental performance. Many organizations, engaged in similar activities, may have widely different environmental management systems and performance, and may all comply with ISO14001.

## Benefits of ISO 14000 Implementation

Environmental benefit would be conservation of other natural resources. For example, a good environmental management program will help reduce the need for electricity, gas, space and water and therefore conserve these valuable commodities. In some parts of the world these resources are in short supply and conservation programs are already in place. Even if they are, there is always more that can be done to conserve or reduce resource use. This not only helps the environment but usually results in a cost savings for the organizations as well.

Theories on the benefits of ISO 14000 implementation vary from researcher to researcher. Generally they can be said that :

Firstly, one should investigate the intention of ISO in this Environmental Management System (EMS) standard. This EMS standard is intended for any organization that wishes to(Ritchie and Hays,1998) :

- a) implement, maintain and improve an environmental management system,
- b) assure itself of its conformance with its stated environmental policy,
- c) demonstrate such conformance to others,
- d) seek certification/registration of its environmental management system by an external organization,
- e) make a self-determination and self-declaration of conformance with international standard.

Secondly, Stapleton (1996) states that the key benefits of an environmental management system are ;

- improved environmental performance,
- reduced liability,
- new customers/market,
- enhanced employee morale,
- competitive advantage,
- improved compliance,
- increase efficiency/reduced costs,
- fewer accidents,
- improved public image,
- enhance customer trust,
- better access to capital.



Thirdly, in conclusion, IISD (International Institute for Sustainable Development) stated that the benefit of having ISO 14001 certification can be divided into two different categories: internal benefits and external benefits. Benefits which aid an organization in its own operations and private concerns are internal whereas external benefits have to do with relationships between an organization and outside parties.

**Internal benefits include (IISD, 1996):**

- a reduction in environmental incidents and liability,
- an increase in efficiency of operations and process,
- an improvement in the environmental and financial performance of the company, and
- an improved approach and attitude towards environmental responsibility within the top management of a company within the company as a whole.

**External benefits are by :**

- providing recognition and assurance of conformity through third party verification,
- a right of passage into business markets,
- a reduction in regulatory demands, a sign of due diligence, improved public and community relations and improved investor confidence.

Fouly, a business that implements the standards can expect a number of benefits that will ultimately improve the bottom line. First, a carefully designed and fully implemented environmental management program provides evidence to stakeholders that the company is serious about environmental management. Tangible benefits include maintaining good relations with the public and government organizations, enhancing the company's image, and increasing its market share. Market pressure is one of strongest reasons for becoming certified. Companies that become ISO14001 certified will have a competitive advantage over non-certified companies, which, in turn, creates pressure for the non-certified companies to become certified. ISO14001 certification may be needed to fulfill contractor requirements or as a condition of placing a purchase order (Stapleton and Cooney, 1996). Some companies may use only those subcontractors who are certified.

Because the EMS emphasizes prevention, savings can be realized through waste minimization and prevention of pollution activities that result in a reduction in the use of raw materials, energy, and hazardous materials. Companies that implement an EMS often find new opportunities to increase efficiency, to reduce paperwork, and to lower costs in other ways.

The EMS should also result in fewer uncontrolled releases of hazardous materials and should demonstrate "due care" in environmental matters, which will reduce potential liability. In the U.S., responsible party transfer laws and the Securities and Exchange Commission's (SEC) environmental disclosure requirements can make property sales and mergers difficult unless a comprehensive environmental management program is in place. Other related benefits include a more favorable relationship with lending institutions, improved access to capital, and reasonably priced insurance.

Companies that participate in the global marketplace can expect a level international playing field. ISO14001-certified companies will be able to minimize multiple inspections and registration, differing labeling requirements, environmental trade barriers, and the costs associated with these problems. The acceptance of a single standard by the global community will allow companies to implement an EMS without fear of being placed at a competitive disadvantage(Sayre,1996).

Companies can take pride in their competition to a cleaner, healthier environment for their communities and in improving the global environmental health. Closer to home, implementation of ISO14000 allows each participating company to contribute in a real and substantial way to cleaning up the environmental in their communities and to improving the health of their workers and other in the community (Ritchie and Hayes,1998).

Finally, the benefits of an effective environmental management system can be realized in :

Table 2-2 The benefits of an effective environmental management system  
(Source:<http://www.quality.org//iso14000.faq>)).

<u>Cost Savings</u>
<u>Customer Requirements</u>
<u>Corporate Image</u>
<u>Legislation</u>
<u>Investment</u>
<u>Insurance</u>
<u>Marketing Opportunities</u>

**Costing Saving**

Successful environmental management will evaluate all opportunities for cost saving, the most common benefits derive from a review of resource/energy utilization and its efficiency, forcing full consideration of alternative energy sources and their cost effectiveness(Cascio,1994). The other primary element will be minimization of waste and cost of disposal.

The ISO 14001 standard does not specifically set out to reduce cost or improve material or energy savings, but such saving could be a significant by product of implementing the ISO 14001 environmental management system. The review and



policy statement suggests addressing these impacts for organizations that have significant energy and material use (Marcus, 1997).

### **Customer Requirements**

Many companies have addressed the management system for customer requirements related to quality and ISO9000. The range and diversity of customer needs and expectations is constantly growing with many customers increasing preference for use of suppliers and sub-contractors who can demonstrate that they are good environmental citizens(Koomchana,1996). No customer would want to risk a tarnished reputation (or non-compliance to legislation) from the poor environmental performance of their suppliers and sub-contractors. The safest option for the customer is to use suppliers and sub-contractors who can demonstrate their positive environmental performance(Watson,1997).

### **Corporate Image**

The ability to demonstrate a responsible environment attitude can dramatically improve the image of the corporation fostering better relations with the company's stakeholders. Even more importance is always highly damaging.

### **Legislation**

The scope and severity of environmental legislation is ever increasing. A management system that ensures recognition of the requirements and compliance with them will ensure that fines are avoided and staffs are not imprisoned in addition to avoidance of the publicity that inevitably follows an environmental prosecution (Cascio,1996).

### **Investment**

The inverters are increasingly moving to green portfolio's, and it is interesting that the financial performance of these portfolios has been good in comparison to more traditional investment. In seeking additional investment for the organization it is sensible to ensure the widest scope and this is only aided by a demonstrably sound environment performance.

### **Marketing Opportunities**

All companies seeking growth obviously want their product and services attractive to a widest possible market. Poor environmental performance will encourage many potential customers to decide not to buy from the company, good environmental performance will ensure continuation of the widest possible market.

## Cost Involved

Percy Barnevik, President of ABB said as long as 1995 (at the environment North Sea Conference in Scavenger), "There is still, in many places, a general perception that eco-efficiency means higher costs, lower profit—a sort of sacrifice you must do with respect to shareholder interests. However, if you look at the real world, you find, among companies, a strong and positive correlation between being at the forefront of eco-efficiency and being profitable and general successful. It is not a contradiction, it is a correlation."

On the other hand, the results of the United Nations Industrial Development Organization (UNIDO) survey, the high costs involved in participating in ISO 14001 are one of the main reasons which make developing country participation difficult. High costs for consultants and for obtaining and maintaining certification are posing particular problems for smaller firms. An estimate based on ISO9000 experience shows that a small company that has no environmental program and no quality system in place might have to calculate about US\$90,000 for consultant fees, \$20,000 for registration costs and \$10,000 for registration maintenance costs which occur every six months. In addition, costs arise in connection with analysis, documentation and auditing of the EMS and the training of employees (Hillary, 1997).

Cost is a major factor in the success of implementation. As Goodman and Veritas (1997) mentioned that the fear of the initial cost of implementing an EMS could be discouraging to some organizations; while Chin et al. (1998) argued that organizations develop ISO14000 EMS for improvement of environmental performance and minimization of costs of noncompliance.

## Reduced Cost

After some initial costs have been incurred to design and implement missing programs and to obtain certification, there should be long-term cost savings, especially in the area of environmental control and cleanup. It has been estimated that over \$100 billion is spent annually in the United States to comply with federal regulations pertaining to environmental control and pollution cleanup. This figure was estimated by the U.S. Environmental Protection Agency (NCMS, 1994). Certification will not eliminate all cleanup costs, however, it should minimize the number and size of future cleanups (Marcus, 1997).

If initial and ongoing certification costs are properly managed, there should be a long-term reduction in environmental costs and increase in competitive edge. Since most organizations will be incurring the initial costs, there should not be a serious effect on an organization's competitive status. The costs will be partially offset by increased customer satisfaction, trust in the organization and higher morale. Those organizations that become certified early will have a powerful public-image advantage which can impact cost in a positive way. Innovation and ingenuity of employees in this work can provide a company with an edge in lowering costs to meet the standards. Hence, these qualities should be sought in the search for employees and encouraged in existing employees.



Once certification has been obtained, less time and money will have to be spent responding to customer questions. Presently most customers have a different and lengthy list of environmental questions. To show the organization's ISO 14001 certification will probably be enough for most customers (NCMS, 1994).

The primary basis of the cost savings will be due to less chemicals and wastes handled or cleaned up. Fewer chemicals, fewer poor grade chemicals, fewer chemical spills and less hazardous waste which must be tracked and disposed of properly would be involved. Ground-water cleanups will be minimized.

Another reason for cost savings is due to the philosophy of doing it right the first time. This concept applies to ISO 9000 and numerous other applications as well. In terms of environmental management it is especially important, however, since doing it wrong one time can result in monumental cost and impact (Wortham, 1993).

## **Cost/Benefit Relationship**

When management systems are implemented, they will not only protect lives, but they will also reduce the costs associated with loss of productivity and morale, equipment replacement costs and loss in time to correct and prevent recurrence.

Since environmental management and employee health and safety are so closely related, when one-field benefits from a major change, it is highly probable that the other will as well. Systems that protect or minimize impact on the employees. This equates to reduced employee injuries and illness. After all, the employee is really part of the overall environment (Kuhre, 1995).

### **Identify and Quantify Environmental Costs**

The types of costs (hidden or otherwise) are attributed to every activities which are difficult to identify and measure or estimate. A company seeking to control environmental costs can go only so far to optimize its production waste management system to improve efficiency. Steps taken may include seeking economies of scale in on-site treatment or use of outside waste management vendors, reengineering current waste handling processes to eliminate unnecessary steps, and auditing off-site waste waste disposal vendors to control potential liabilities.

Anther way of accomplishing the same result may be to take the chargebacks to the procurement department and add environmental costs to price of the inputs used, be they raw materials, catalysts, paints, cardboard, or solvents. This produces a true cost of using a particular material. The goal is the same—to motivate responsible managers to analyze existing materials' use and processes to identify fanatically and environmentally better alternatives.

While the potential benefits of applying environmental accounting are substantial, at the design stage it currently is far easier to consider environmental factors in a qualitative way than it is to employ environmental accounting to provide the inputs of dollars and cents. Although many companies can readily determine the environmental

costs of what they do or have done, they rarely have handy the prospective costs of a menu of alternative ways of doing things.

More importantly, because designers do not directly face profit and loss responsibility, cost allocation is less likely to work as a motivational tool for them under most existing incentive structures. Environmental costs and performance can, however, be made a design criterion. To address this problem more directly, managers can ensure that designers both receive tools (and, as needed, training on their use) incorporating relevant information and use those tools to design with the environment and environmental costs in mind.

## Cost-Benefit Analysis

In the book of “competitive Advantage”, Michael Porter introduced a new concept --- value chain. Value chain can be used as a systematic way of examine all the activities a firm performs and how they interact is necessary for analyzing the sources of competitive advantage. ISO 14001 is also a systematic way which encompasses a full range of issues of a company including those with strategic and competitive implications (Porter,1990).

Therefore, value chain was used as a basic tool for analyzing the potential costs and benefits in implementing ISO 14001. In “ISO 1400 guidance document General Guidelines on Principles and Supporting Techniques” (Committee Draft, February 1995), it is added that tracking environmental benefits and costs can support the appropriate allocation of resources for achieving environmental objectives.

### □ The Value Chain

The value chain displays total value, and consists of value activities and margin. Value activities are the physically and technologically distinct activities a firm performs. These are the building blocks by which a firm creates a product valuable to its buyers. Margin is the difference between total value and the collective cost of performing the value activities.

Value activities can be divided into two broad types, primary activities and support activities. Primary activities, are the activities involved in the physical creation of the product and its sale and transfer to the buyer as well as after-sale assistance. Support activities support the primary activities and each other by providing purchased inputs, technology, human resources, and various firmware functions.

The systematic examination of individual value activities can lead to a better understanding of a corporation's strengths and weakness. According to Porter, “Differences among competitor value chains are a key source of competitive advantage”(Simon&Schuster, 1985).



Table 2-3 : The primary and supporting activities of the value chain.

Primary Activities	Supporting Activities
<ul style="list-style-type: none"><li>• Inbound Logistics</li><li>• Operations</li><li>• Outbound Logistics</li><li>• Marketing and Sales</li><li>• Services</li></ul>	<ul style="list-style-type: none"><li>• Management System</li><li>• Human Resource Management</li><li>• Technology Development</li><li>• Procurement</li></ul>

*\* Primary Activities*

There are 5 generic categories of primary activities involved in competing in any industry. Each category is divisible into a number of distinct activities that depend on the particular industry and strategy:

- **Inbound Logistics:** Activities associated with receiving, storing, and disseminating inputs to the product, such as material handling, warehousing, inventory control, vehicle scheduling, and returns to suppliers.
- **Operations:** Activities associated with transforming inputs into the final product form, such as machining, packaging, assembly, equipment maintenance, testing, printing, and facility operations.
- **Outbound Logistics:** Activities associated with collecting, storing, and physically distributing the product to buyers, such as finished goods warehousing, material handling, delivery vehicle operation, order processing, and scheduling.
- **Marketing and Sales:** Activities associated with providing a means by which buyers can purchase the product and inducing them to do so, such as advertising, promotion, sales force, quoting, channel selection, channel relations, and pricing.
- **Service:** Activities associates with providing service to enhance or maintain the value of the product, such as installation, repair, training, parts supply, and product adjustment.

*\* Support Activities*

Support value activities involves in competing in any industry can be divided into four generic categories. As with primary activities, each category of support activities

is divisible into a number of distinct value activities that are specific to a given industry.

- **Procurement:** Procurement refers to the function of purchasing inputs used in the firm's value chain, not to the purchased inputs themselves.
- **Technology Development:** Every value activity embodies technology, be it know-how, procedures, or technology embodied in process equipment. Technology development consists of a range of activities that can be broadly grouped into efforts to improve the product and the process. It tends to be associated with the engineering department or the development group.
- **Human resource Management:** Human resource management consists of activities involved in the recruiting, hiring, training, development, and compensation of all types of personnel.
- **Firm Infrastructure:** Firm infrastructure consists of a number of activities including general management, planning, finance, accounting, legal, government affairs, and quality management.

## Competitive Advantage

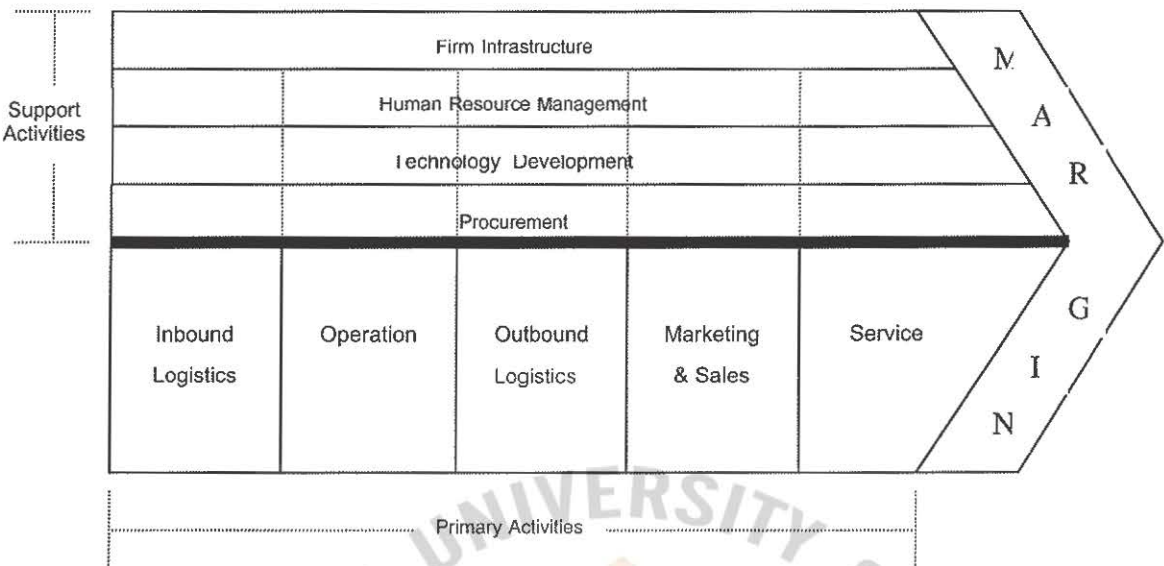
Competitive advantage grows out of the way firms organize and perform discrete activities. The operations of any firm can be divided into a series of activities such as salespeople making sales calls, service technicians performing repairs, scientists in the laboratory designing products processes, and treasurers raising capital.

Firms create value for their buyers through performing these activities. The ultimate value a firm creates is measured by the amount buyers are willing to pay for its product or service. A firm is profitable if this value exceeds the collective cost of performing all the required activities. To gain competitive advantage over its rivals, a firm must either provide comparable buyers value but perform activities more efficiently than its competitors (low cost).

The activities performed in competing in a particular industry can be grouped into categories as show in Figure 2-2. Activities can be divided broadly into those involved in the ongoing production, marketing, delivery, and servicing of the product (primary activities) and those providing purchased inputs, technology, human resources, or overall infrastructure functions to support the other activities (support activities).



**Figure 2-2**    Generic Value Chain  
 (Source: Michael E. Porter, competitive advantage)



Competitive advantage is increasingly a function of how well a company can manage this entire system. Linkages not only connect activities inside a company but also create interdependencies between a firm and its suppliers and chanel(Porter,1990). A company can create competitive advantage by better optimizing or coordinating these links to the outside.

□ **Potential Costs and Benefits of an EMS**

According to the concepts of value chain and environmental costs, potential costs and benefits of implementing EMS can be summarized as the following. (Source: the course of “Business Environmental Management” in AIT, Dr Andreas Sturm, 1997).

Table 2-4 : The cost factors in implementation.

Primary Activities	Supporting Activities
Inbound Logistics	Management System
Operations	Human Resource Management
Outbound Logistics	Technology Development
Marketing and Sales	Procurement
Services	

**\* Potential costs**

**Supporting Activities**

**Management system (Firm Infrastructure)**

- Building up the system
- Maintaining the system
- Certifying the system

**Human resource management**

- Training and education
- Building up awareness

**Technology development**

- Redesigning products
- Redesigning production processes

**Procurement**

- Development of an environmental management handbook
- Implementation of the new procurement
- Auditing the system

**Primary Activities**

**Operations**

- Pollution abatement technology
- Waste separation

**Inbound logistics**

- Consumption of energy, water and other input materials
- Storage cost

**Outbound logistics**

- Packaging cost
- Transportation cost

**Marketing and Sales**

- Communication costs
- Labeling costs

**Service**

- Development and implementation of a repair and upgrade services



Table 2-5 : The benefit factors in implementation.

Primary Activities	Supporting Activities
Inbound Logistics	Management System
Operations	Human Resource Management
Outbound Logistics	Technology Development
Marketing and Sales	Procurement
Services	

*\* Potential benefits*

**Supporting Activities**

**Management system**

- Improved public image
- Better relations with public authorities, communities, green activist groups
- Attracting shareholders/investors
- Better information on source of environment impact, early identification of problems
- Better information on costs and potential savings

**Human resource management**

- Increased awareness
- Higher staff commitment and better labor relations

**Procurement**

- More efficiency and security due to environment management handbook
- Easier compliance with environment standards
- Obtaining insurance at reasonable cost
- Facilitates obtaining permits and authorization

**Primary Activities**

**Inbound logistics**

- Reduced consumption of energy, water and other input materials
- Less material input leads to lower storage costs

**Operations**

- Reduced charges, pollution penalties, compensations payments
- Lower waste costs
- Lower environmental risk, lower insurance costs
- Productivity improvement

**Outbound logistics**

- Reduced packaging costs
- Reduced transportation costs

## Marketing and Sales

- Increased market share due to product innovation (e.g. combined with an ecolables)
- New products open up new markets
- Ensured access to foreign markets
- Lower life-cycle costs
- Increased demand for traditional products and services which contribute to pollution abatement

## Service

- Repair and upgrade service opens up new markets
- Environmental information/ consulting improves client relations

Every firm is a collection of activities that are performed to design, produce, market, deliver, and support its product. The value chain identifies nine strategically relevant activities that create value and cost in a specific business. These nine value-creating activities consist of five primary activities and four support activities.

The primary activities represent the sequence of bringing materials into the business (inbound logistics), converting them into final products (operations), shipping out final products (outbound logistics), marketing them (marketing and sales), and serving them (service). The supporting activities---procurement, technology development, human resource management, and management system---are handled in certain specialized departments, but not only there (Kotler, 2000).

The concept of "value chain" has been integrated in the potential costs-benefits analysis in EMS, it proposed a systematic approach for analyzing costs and benefits on the company level. During this potential costs-benefits analysis, both quantitative and qualitative methods will be used because of the complexity of the EMS of one company (Sturm, 1997).



# Chapter 3

## Research Framework

This chapter is to demonstrate the cost-benefit framework in each activities of EMS implementation and to support selected companies in achieved certification. The demonstrate thesis will serve as a basis for the development of an EMS guide for other companies which have not yet been provided by ISO(Hussey, 1996).

The ISO14001 international EMS standard, although voluntary, is expected to become business requirement in certain industry sectors. Whereas certification to ISO14001 could have positive trade effects for developing country producers, companies that are not certified may suffer adverse trade effects(Hillary, 1997). Producers in developing countries---small firms in particular---may find the high costs involved in implementing and certifying an EMS prohibitive.

Implementing a comprehensive EMS increases costs initially, and these cost may be critical for small to medium size companies(Ritchie and Hays, 1998). Market-driven pressure for ISO certification may pose a trade berries for these companies if they cannot commit their activities.

In order to avoid potential trade barriers, developing countries need to participate more actively in the preparation of international standard such as ISO14000. Developing countries will need technical assistance in order to build up an infrastructure that allows them to participate effectively in the ISO14001 scheme. Firms in developing countries could benefit from cooperative arrangements within the private sector(Ruth, 1997).

This framework is a conceptual of how one the relationships among the several factors that have been identified as important to the problem.

Based on the literature, a conceptual framework shown in Figure 3-1 has been developed to study the cost and benefit factors of ISO 14000 certification.

**Independent Variables**

**Dependent Variables**

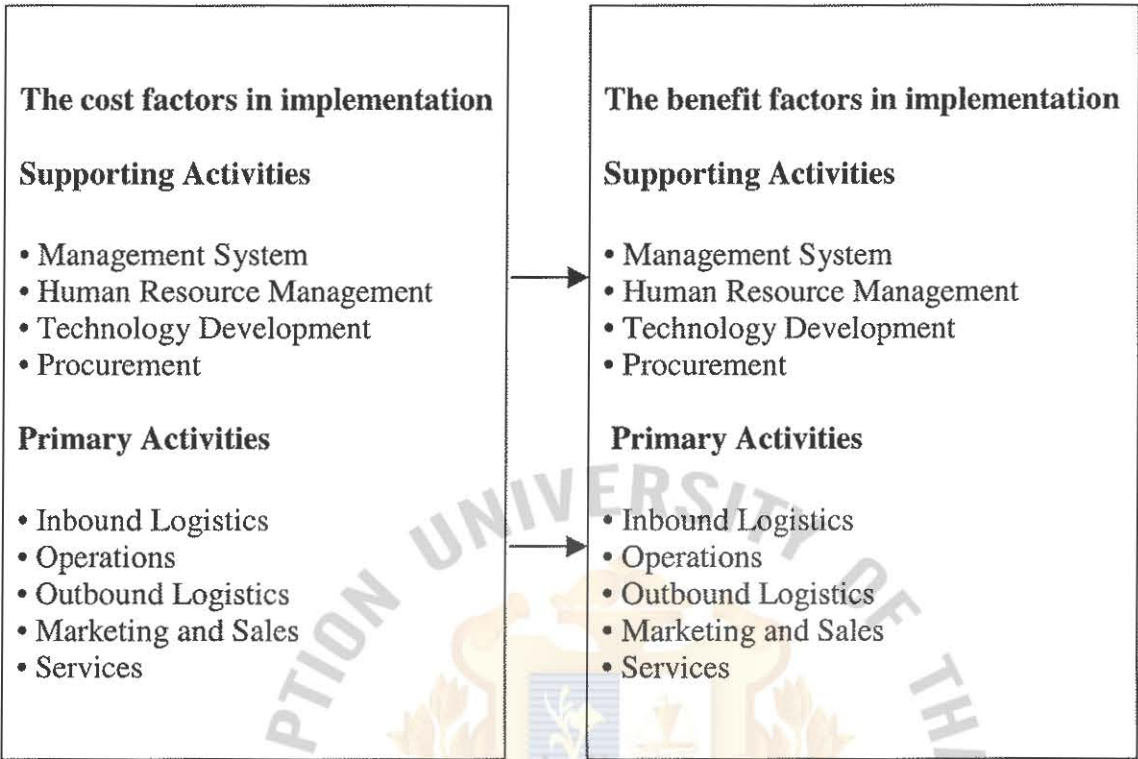


Figure 3-1 Conceptual framework of the cost and benefit factors of ISO 14000 implementation

**Hypothesis Statements**

This study is to identify and examine the relationship(s) between the benefit(s) of environmental management systems and the used costs for ISO14000 implementation. The conceptual framework can be translated into the hypothesis of this study in the alternative form as;

- H1o : Benefit is not higher than the cost of implementing management system due to ISO14000.
- H1a : Benefit is higher than the cost of implementing management system due to ISO14000.

- H2o : Benefit is not higher than the cost of implementing human resource management due to ISO14000.



- H2a : Benefit is higher than the cost of implementing human resource management due to ISO14000.
- H3o : Benefit is not higher than the cost of implementing technology development due to ISO14000.
- H3a : Benefit is higher than the cost of implementing technology development due to ISO14000.
- H4o : Benefit is not higher than the cost of implementing procurement due to ISO14000 .
- H4a : Benefit is higher than the cost of implementing procurement due to ISO14000.
- H5o : Benefit is not higher than the cost of implementing inbound logistics due to ISO14000.
- H5a : Benefit is higher than the cost of implementing inbound logistics due to ISO14000.
- H6o : Benefit is not higher than the cost of implementing operations due to ISO14000.
- H6a : Benefit is higher than the cost of implementing operations due to ISO14000.
- H7o : Benefit is not higher than the cost of implementing outbound logistics due to ISO14000.
- H7a : Benefit is higher than the cost of implementing outbound logistics due to ISO14000.
- H8o : Benefit is not higher than the cost of implementing marketing and sales due to ISO14000.
- H8a : Benefit is higher than the cost of implementing marketing and sales due to ISO14000.
- H9o : Benefit is not higher than the cost of implementing service due to ISO14000 .
- H9a : Benefit is higher than the cost of implementing service due to ISO14000 .

# Operational Definition of Variables

An operation definition is a definition stated in term of specific testing criteria or operations. That is the definition must specify the characteristics to study and how they are to be observed (Cooper and Schindler, 1998). The measurement of dependent / independent variables will be done through operationalization of those variables as following table:

Table 3-1 Operationalization of variables

Variables	Operationalization	Measurement Scale
<b><u>Independent</u> (cost)</b>		
Management System	<ul style="list-style-type: none"><li>- Building up the system</li><li>- Maintaining the system</li><li>- Certifying the system</li></ul>	Interval
Human Resource Development	<ul style="list-style-type: none"><li>- Training and education</li><li>- Building up awareness</li></ul>	Interval
Technology Development	<ul style="list-style-type: none"><li>- Redesigning products</li><li>- Redesigning production process</li></ul>	Interval
Procurement	<ul style="list-style-type: none"><li>- Development of an environmental management handbook</li><li>- Implementation of the new procurement</li><li>- Auditing the system</li></ul>	Interval
Operations	<ul style="list-style-type: none"><li>- Pollution abatement technology</li><li>- Waste separation</li></ul>	Interval
Inbound Logistics	<ul style="list-style-type: none"><li>- Consumption of energy</li><li>- Storage cost</li></ul>	Interval
Outbound Logistics	<ul style="list-style-type: none"><li>- Distributing products to buyers</li></ul>	Interval
Marketing and Sales	<ul style="list-style-type: none"><li>- Communication costs</li><li>- Labeling costs</li></ul>	Interval
Services	<ul style="list-style-type: none"><li>- Development and implementation of repair and upgrade services</li></ul>	Interval



Variables	Operationalization	Measurement Scale
<b><u>Dependent( benefit)</u></b>		
Management System	<ul style="list-style-type: none"> <li>- Improved public image</li> <li>- Better relations with public authorities</li> <li>- Attracting shareholders</li> <li>- Better information on source of environmental impact</li> </ul>	Interval
Human Resource Development	<ul style="list-style-type: none"> <li>- Increased awareness</li> <li>- Higher staff commitment and better labor relations</li> </ul>	Interval
Technology Development	<ul style="list-style-type: none"> <li>- Creativity and openness to new challenges</li> </ul>	Interval
Procurement	<ul style="list-style-type: none"> <li>- More efficiency and security due to environmental management handbook</li> <li>- Obtaining insurance at reasonable costs</li> </ul>	Interval
Operations	<ul style="list-style-type: none"> <li>- Lower waste costs</li> <li>- Lower environmental risk</li> <li>- Productivity improvement</li> </ul>	Interval
Inbound Logistics	<ul style="list-style-type: none"> <li>- Reduced consumption of energy</li> <li>- Less material input leads</li> </ul>	Interval
Outbound Logistics	<ul style="list-style-type: none"> <li>- Reduced packaging costs</li> <li>- Reduced transportation costs</li> </ul>	Interval
Marketing and Sales	<ul style="list-style-type: none"> <li>- Increased market shares</li> <li>- Increased demand</li> <li>- Ensured access to foreign markets</li> </ul>	Interval
Services	<ul style="list-style-type: none"> <li>- Repair and upgrade services new markets</li> <li>- Environmental information</li> </ul>	Interval

# Chapter 4

## Research Methodology

### Research Method

#### 1. Census Survey Method

Data source comes from primary data and secondary data collection. Primary data is mainly based on the mail survey as the survey aims to reach all 61 ISO14000 certified companies. Bilingual version questionnaires (English and Thai) are sent to the management level people in the company in order to increase the reliability and accuracy of the data. With the questionnaire, one official letter from ABAC graduate office, and one request letter from the author to ask the respondents to fill up the questionnaire and one self-addressed stamped envelope are enclosed to send to interviewers. This activity is initiated from 12<sup>th</sup> of February 2001. After a week of mailing the questionnaires about 19<sup>th</sup> of February 2001, the concerned persons are called upon to ascertain the receipt of the questionnaires. A week after the confirmation of receipt, the concerned person is called up again to track the progress with the questionnaire and requested to have the filled questionnaires mailed at the earliest. This process is continued till the questionnaires are received on March 6, 2001. However, some cases are made by phone to the companies, which had not sent back the questionnaire to remind them to fill up the questionnaire and send them back. Meanwhile, the author went to some companies in person to pick up the questionnaire and conduct the follow up interview as well.

Follow-up interview is conducted by mail, telephone, face-to-face which interview is also conducted to classify unclear questions. Secondary data is collected from publications, related books, periodicals, newspaper articles, previous researches, journals and Internet to study the situation of electronic industry in Thailand, the knowledge of ISO14000 and background of ISO14000 certified companies in electronic industry in Thailand.

#### 2. Instrument Design

A structured questionnaire is designed in order to extract the reliable information with regard to independent and dependent variables. Each variable is transformed into simple, easy and concise statements, which totally exclude the possibilities of ambiguity, illusions and misinterpretations(Cooper,1995). The researcher has conducted a pretest with 10 companies considered as target population. In this pretest, researcher has looked for evidence of ambiguous questions, wording, question format and sequence as well as the length of question. All respondents were asked to fill out the questionnaire, whereas, some of them were interview after they completed the questionnaire to know whether above problems occurred.



During the process of distribution of questionnaires, the concerned person in the organizations, especially the senior or high-level manager who has responsibility and authority, facility manager, safety manager, is called upon individually based on the addresses available in the list of the ISO14001-certified companies provided by TISI(Source : <http://www.tisi.go.th>).

Self-administered questionnaire is designed for the mail survey. The measuring instrument for the costs and benefits is a five-point likert scale. Respondents are asked to mark the degree of opinion on ISO14001 certification in term of costs and benefit on a scale of 1 to 5 with 1 being “no cost/benefit” and 5 being “extremely high costs/benefits”.

The questionnaire was designed in bilingual(English and Thai) to avoid confusion in language before mailing in order to make Thai respondents understand well. It comprises of two main sections as follow :

- ❑ Section I : General Information
- ❑ Section II : Costs and Benefits in EMS

The detailed questionnaire is shown in Appendix I

### **3. Population of Interest**

The population frame in this research is comprised of the ISO14001-certified companies in electronics sector of Thai industries. An updated list of the ISO14001-certified companies is obtained from Thailand Industrial Standards Institute (TISI). In the list, it is seen that the number of companies that have been awarded ISO14001 Certification is greatest in the electronics industry, which has registered 61 companies (source : <http://www.tisi.go.th/14000/isolist.html>). The list of the ISO14001-certified organizations in electronic industry is in table 4-2. The large number of respondents in the electronics industry is the basis for the selection of this industry for this research. The individual who can provide information must also be familiar with basic concepts of management systems in order to give a real information on the topic of environment systems and also have the qualities and qualifications to give opinion to the costs and benefits on environmental management system.

### **4. Sampling Element**

The senior or high-level manager who has responsibility and authority, facility manager, safety manager, is called upon individually based on the addresses available in the list of the ISO14001-certified companies provided by TISI(Source : <http://www.tisi.go.th>).

### **5. Sampling Unit**

The list of the companies in electronic industries having ISO14001 certification is giving in table 4-2 at the end of this chapter. Moreover, the figures of the ISO 14001-certified organizations from various industries is attached as Appendix II

6. Data Analysis

The most famous technique that indicates the relationship of one variable to another is simple **correlation analysis**. The simple **correlation coefficient** is a statistical measure of the covariance or association between two variables as described by Grimm(1993) and Zikmund(1994). The correlation coefficient(*r*) ranges from +1 to -1. The larger the absolute value of the correlation, the stronger association between two variables. i.e. if the value of *r* is 1, there is a perfect positive relationship; while if the value of *r* is -1, a perfect negative relationship or a perfect inverse relationship is indicated. No correlation is reflected if *r* = 0. A correlation coefficient demonstrates both the magnitude of the relationship and the direction of the relationship (Cooper,1995).

In order to analyze and render the collected data in an understandable format, descriptive and bivariate statistic are employed in order to investigate significance of the relations between the independent variables and the dependent variable. These analyses are carried out with the Statistical Package for Social Sciences (SPSS).

- **Descriptive analysis** is performed to derive the average score and qualitative rating in order to observe the mean of variables within the company based on the average of occurrence, This type of analysis has been adopted by Vloeberghs and Bellens(1996), Hall et al.,(1994), Homison(1996), Rongrotsakorn(1998)), Lohachitaks(1998), Thapa(1999) and many other researchers to demonstrate the descriptive aspects of the implementation processes.

From this thesis study, the mean scores were weighted into two categories as follows:

Cost Average Score

Rating Scales	Interpretation
5.00-4.20	Extremely High Costs
4.19-3.40	High Costs
3.39-2.60	Appropriate Costs
2.59-1.80	Low Costs
1.79-1.0	No Cost

Benefit Average Score

Rating Scales	Interpretation
5.00-4.20	Extremely High Benefits
4.19-3.40	High Benefits
3.39-2.60	Appropriate Benefits
2.59-1.80	Low Benefits
1.79-1.0	No Benefit



**Statistical treatment of data**

The Statistical Package for Social Science (SPSS) will be used to summarize the data where collected. All statistical manipulations of the data follow commonly accepted research practices. The form of data presentation from these procedures would also be presented in an easily interpretable format. All statistical procedures are performed to ensure accuracy and to minimize costs to the client. After collecting the data from 61 copies of questionnaires, the data are coded into the symbolic form that are used in SPSS software.

The data was summarized in the form of simple frequency and descriptive statistics. The following statistical data will analyze the answer of each question that constructed in statements of problem and hypotheses.

**Table 4-1 : The test of hypothesis**

Hypotheses	Statistic
1. Benefit is not higher than the cost of implementing management system due to ISO14000.	Pearson Correlation
2. Benefit is not higher than the cost of implementing human resource management due to ISO14000.	Pearson Correlation
3. Benefit is not higher than the cost of implementing technology development due to ISO14000.	Pearson Correlation
4. Benefit is not higher than the cost of implementing procurement due to ISO14000.	Pearson Correlation
5. Benefit is not higher than the cost of implementing inbound logistics due to ISO14000.	Pearson Correlation
6. Benefit is not higher than the cost of implementing operations due to ISO14000.	Pearson Correlation
6. Benefit is not higher than the cost of implementing outbound logistics due to ISO14000.	Pearson Correlation

7. Benefit is not higher than the cost of implementing marketing and sales due to ISO14000.	Pearson Correlation
8. Benefit is not higher than the cost of implementing service due to ISO14000 .	Pearson Correlation

- Test of Hypothesis** is conducted by employing bivariate correlation statistic. The most commonly used technique for assessing correlation and the most reliable estimate of correlation technique, Pearson's  $r$  is used, which is appropriate when both variables are expressed as interval data or ratio data. The correlation technique used is based on the assumption that the relation being investigated is linear, therefore it does not account for curvilinear relations, which is very unlikely in this study. This research is also looking forward for the benefit of examining relationships for defining. Since when two variables are lumped together a relationship may be difficult to find or an inaccurate estimate of relationship could occur. The correlation analysis is an analysis to support the relation between cost and benefit of environmental management systems by the means of hypothesis testing. Conclusion is then possible for this researched based on this hypothesis test. The hypotheses testing is performed at 95% confidence interval, or at the level of significance  $\alpha = 0.05$ . The p value can be obtained from SPSS. The critical test value  $\alpha = 0.05$ . If  $p < 0.05$ , then null hypothesis is rejected. Otherwise, if  $p > 0.05$ , null hypothesis is accepted.

**Table 4-2 The list of ISO14001-certified organizations in electronic industry (61 companies) : Radio, TV, communication equipment.**  
 (Source : <http://www.tisi.go.th/14000/isolist.html>).

No	Company	Standard	Scope of certification	Certificated by
1	Kyushu Matsushita Electric (Thailand) Co., Ltd. 101 mu 2 Theparak Rd, Bangsaonthong, Samut Prakan 10540	ISO 14001	TV, radio,home stereo	(CB not known) 3-Jul-98
2	Capetronic International (Thailand) PCL 105 mu 5 Bangna-Trat Rd km.52, Cahchoengsao; tel (038) 573161	ISO 14001	Manufacture of full range of computer monitors and PCB sub assemblies	AJA EQS 17-Feb-98



3	KSS Electronics (Thailand) Co., Ltd. Northern Region Indus.Estate, 89 mu 4 Ban Klang, Muang, Lamphun 51000	ISO 14001	Operating of a Plant for manufacturing of Quartz Crystals and Quartz Crystal Application Products	TEI 20-Dec-99
4	KSS Electronics (Thailand) Co., Ltd. Northern Region Indus.Estate, 89 mu 4 Ban Klang, Muang, Lamphun 51000	ISO 14001	Operating of a Plant for manufacturing of Quartz Crystals and Quartz Crystal Application Products	JACO 28-Dec-99
5	JVC Manufacturing (Thailand) Co., Ltd. 107 mu 18, Nawanakhon Indus.Estate Zone 3, Khlong Luang, Pathumthani; tel 5292210; fax 5292241	ISO 14001	Manufacture and assembly of colour television receiver, electronic equipment and parts	TISI 19-Apr-99
6	JVC Componente (Thailand) Co., Ltd. 555 Moo 6,T.Nongravieng,A.Muang Nakornratchasima Nakornratchassima Tel: (044) 212905-12, Fax: (044) 212-913	ISO 14001	The manufacture of inductor (deflection yoke) , small size percies motor, and video head.	SGS 24-Jan-00
7	Sanyo Semiconductor (Thailand) Co., Ltd. 1/7 mu 5 Rojana Industrial Park T. Kamham, A. Utai Ayuttaya 13210 Tel: (035) 330110-9, Fax: (035) 330189	ISO 14001	Manufacture of semiconductor devices; transistors and large scale integrated circuits	SGS 27-Apr-98
8	Samsung Electro-Mechanics (Thailand) Co., Ltd. Wellgrow Indus. Estate, 93 mu 5, Bang Sama, Bang Pakong, Chachoengsao; tel 038 570191; fax 570311	ISO 14001	Manufacture of tuners; deflector yokes; fly back transformers; high voltage capacitor	UL 14-Sep-96
9	Samsung Electro-Mechanics (Thailand) Co., Ltd. Wellgrow Indus. Estate, 93 mu 5, Bang Sama, Bang Pakong, Chachoengsao; tel 038 570191; fax 570311	ISO 14001	EMS associated with activities, products and services	UL 23-Aug-99

10	Summit Electronics Components Co., Ltd. 99 mu 5 soi Wat Sivarinnoi, Bangsaothong, Samut Prakan 10540; tel 3371553; fax 3371201	ISO 14001	Manufacture of optical devices, car audio complete set, deck for cassette tape and CD player, automotive electronic components	SGS 7-Dec-98
11	Seagate Technology (Thailand) Ltd. (Korat) 90 mu 9 Mittraphap Rd, Sung Noen, Nakhon Ratchasima; tel (044) 286450; fax 286490	ISO 14001	Manufacture of head gimbals assemblies for hard disk drives	SGS 28-Aug-97
12	Seagate Technology (Thailand) Ltd. (Chokchai) 294 Vibhavadi-Rangsit, Lam Lukka, Pathum Thani; tel 5318161; fax 5313764	ISO 14001	Manufacture of hard disc drive and material purchasing, handling and storage at TMC	AJA EQS 18-Sep-97
13	Seagate Technology (Thailand) Ltd. (Tepharuk) 1627 mu 7 Tepruk, Samut Prakan; tel 3835777; fax 3835736	ISO 14001	Manufacture of head gimbals assemblies for hard disk drives	SGS 21-Jan-97
14	Seagate Technology (Thailand) Ltd. (Rangsit) 152/11-13 Thanya Buri, Lam Lukka, Klong 7, Pathum Thani; tel 5774780; fax 5772687	ISO 14001	Manufacture of motor and pole products for computer disk drive	AJA EQS 20-Sep-97
15	Seagate Technology (Thailand) Ltd. (Lat Krabang) (address not known)	ISO 14001	Information not available	AJA EQS (date not known)
16	Seagate Technology (Thailand) Ltd. (Wellgrow) 73 Wellgrow IE., Bangna-Trat km.36, Bang Pakong, Chachoengsao; tel (038) 570514- 21; fax 570543	ISO 14001	Manufacture of head stack assemblies and components	AJA EQS 3-Oct-97



17	Sumiko Leadframe (Thailand) Co.,Ltd. 1/49 Rojana Industrial Park Moo 5,Tambol Kanhm,Amphur U-thai Ayuttaya 13120 Tel: (035) 226303-7, Fax: 035) 226310	ISO 14001	The manufacture of leadframe for intergrate circuit.	SGS 8-Sep-99
18	Sony Semiconductor (Thailand) Co., Ltd. 140 Mu 5, Bangkadi Industrial Park, Tiwanon Road, Bangkadi, Muang District, Pathumthani 12000, Thailand Tel. 501- 1730 Fax. 501-1065	ISO 14001	Manufacture of Integrated circuit	MASCI 16-Jul-00
19	Sony Mobile Electronics (Thailand) Co., Ltd. Bang Pakong IP 2, Don Huaro, Muang, Chonburi	ISO 14001	Manufacture of audio products and related devices at factory site	TUV Rheinland 1-Feb-98
20	Sony Siam Industries Co., Ltd. 92 mu 1, Hi-tech IE, Ban Len, Bang Pa-in, Ayutthaya 13160;	ISO 14001	Manufacture of color television, audio equipment and related components	TUV Rheinland 1-Mar-98
21	SCI Systems (Thailand) Ltd. 90 mu 1, Tiwanon, Ban Mai, Amphoe Muang Pathum Thani; tel 5012400; fax5012848	ISO 14001	Contract supplier of manufacturing and engineering services to electronics industries; Manufacture and testing of printed circuit boards, electronic assemblies, and turnkey manufacturing including finished product	AJA EQS 14-Apr-97
22	Delta Electronics (Thailand) PCL 699, 701, 703,714 EPZ Bangpoo Industrial Estate, Sukhumvit Road Samuthprakarn 10280 Tel: 7093200, Fax: 709 3790	ISO 14001	Manufacture of computer monitors, magnetic and components, rechargeable battery, switching power supply and adaptor, EMI filter	SGS 8-Oct-98
23	Tatung (Thailand) Co., Ltd. 700/50, 52, 54 mu 6 Nong Maidaeng, Muang, Chonburi 2000; tel (038) 213080- 5; fax 213079	ISO 14001	Computer monitor and colour television (chassis) manufacture	AJA EQS 31-Jul-98

24	Toshiba Display Devices (Thailand) Co., Ltd. 142 mu 25 Bangkadi Indus. Estate, Pathum Thani 12000; tel 5011100,48; fax 5011215	ISO 14001	Manufacture of cathode ray tubes	BVQI 3-Apr-98
25	Toshiba Semiconductor (Thailand) Co., Ltd. 135 mu 5, Bangkadi IP, Tiwanon, Bangkadi, Pathum Thani; tel 5011621-32; fax 5011643	ISO 14001	Manufacture of semiconductor devices	TISI 25-Sep-98
26	Thai CRT Co., Ltd. 87/9 Laem Chabang Indus. Estate, Siracha, Chonburi; tel 038 490220-5; fax 490226	ISO 14001	Manufacture and assembly of cathode ray tube (CTR), deflection yoke (DY) and integrated tube components (ITC)	RWTUV 1-Aug-99
27	Thai CRT Co., Ltd. 87/9 Laem Chabang Indus. Estate, Siracha, Chonburi; tel 038 490220-5; fax 490226	ISO 14001	Manufacture and assembly of cathode ray tube (CTR), deflection yoke (DY) and integrated tube components (ITC)	RWTUV 24-Aug-99
28	Nitsuko Thai Ltd. 60/81 Navanakorn Zone 3 Klongnueng, Klongluang, Pathumthane 12120 Tel : 5292112-4, Fax : 5292115	ISO 14001	The production of single line telephone, Key telephone system, security telephone system, emergency reporting apparatus, cordless key telephone systems and telephone application equipment	JQA 28-Dec-99
29	National Thai Group of Companies (Bangphli) 101 mu 2 Theparak Rd, Bangsaothong, Samut Prakan 10540.	ISO 14001	Electronic parts and electrical products	AJA EQS 3-Jul-98
30	Pelmec Thai Ltd. 1 mu 7 Phahonyothin Rd km.51, Chiang Raknoi, Bangpa-in, Ayutthaya 13180; tel (035) 361503; fax 361477	ISO 14001	Information not available	(CB not known) 27-Oct-97



31	Power Electronics of Minebea Co., Ltd. 5/2 mu 8 Phahonyothin Rd. km.149, Muang, Lopburi	ISO 14001	Information not available	(CB not known) 27-Oct-97
32	Pioneer Manufacturing (Thailand) Co., Ltd. Rojana Indus. Park, 1/31 mu 5 Khanham, Uthai, Ayutthaya 13210; tel 035 226159- 70; fax 330808	ISO 14001	Manufacture of care audio, home audio and audio parts	TEI 30-Oct-99
33	Philips Electronics (Thailand) Co., Ltd. 515 Bangpu Indus. Estate, D5, Samut Prakan; tel 7093300; fax 3230732	ISO 14001	Manufacture of fluorescent lamps and luminaires and assembly of television	SGS 17-Jul-98
34	Philips Semiconductors (Thailand) Co., Ltd. 303 Chaengwatthana, BKK; tel 5527623-9	ISO 14001	Manufacture, testing and package design of integrated circuits	KEMA 10-Sep-96
35	Fujikura (Thailand) Ltd. 101/2 mu 20 Nawanakhon IE., Pathum Thani; tel 5293523-33 ; fax 5290606	ISO 14001	Manufacture of cables, hard disk drive components, cables and wire assemblies, metal dome sheets and flexible flat cables	SGS 13-May-98
36	Fujitsu (Thailand) Co., Ltd. 60/90 mu 19 Nawanakhon IE., Phahonyothin, Pathum Thani; tel 5292597; fax 5292582	ISO 14001	Manufacture and assembly of electronic equipment and parts	TISI 19-May-98
37	Matsushita Electric AVC (Thailand) Co., Ltd. 101 mu 2 Theparak Rd, Bangsaothong, Samut Prakan 10540	ISO 14001	TV, radio, home stereo	AJA EQS 3-Jul-98
38	Matsushita Electronic Components Thailand Co., Ltd. 101 mu 2 Theparak Rd, Bangsaothong, Samut Prakan 10540	ISO 14001	Printed wiring board, tuner, remote control, car switch, speaker, coil, switching, transformer	AJA EQS 3-Jul-98
39	Minebea Group of Companies (Thailand) Co., Ltd (Bang Pa-in) 1 mu 7 Phahonyothin Rd km.51, Chiang Raknoi, Bangpa-in, Ayutthaya 13180; tel	ISO 14001	Factory site	TUV Rheinland 27-Oct-97

	(035) 361503; fax 361477			
40	Minebea Group of Companies (Thailand), Rojana Factory 1/14 mu 5, Rojana IE, Khanham, Uthai, Ayutthaya 13210	ISO 14001	Factory site	TUV Rheinland 1-Oct-97
41	Minebea Group of Companies (Thailand), Lopburi Factory 5/2 mu 8 Phahonyothin Rd. km.149, Muang, Lopburi	ISO 14001	Factory site	TUV Rheinland 1-Oct-97
42	Minebea Group of Companies (Thailand), (Ayutthaya) 18 mu 3 Asia Highway Km.72, Thanu, Uthai, Ayutthaya 13180	ISO 14001	Factory site	TUV Rheinland 27-Oct-97
43	Minebea Thai Ltd. (Ayutthaya Plant 2) (address not known)	ISO 14001	Information not available	(CB not known) (date not known)
44	Minebea Electronics (Thailand) Co., Ltd. (METC) 5/2 mu 8 Phahonyothin Rd. km.149, Muang, Lopburi	ISO 14001	Information not available	(CB not known) 27-Oct-97
45	Murata Electronics (Thailand) Co., Ltd. Northern Region IE, 63 mu 4 Ban Klang, Muang, Lamphun 51000; tel (053) 581166; fax 581076	ISO 14001	Manufacture of electronics components	SGS 5-Oct-98
46	Melco Manufacturing (Thailand) Co., Ltd. 86 mu 4 Bangna-Trat km.23, Samut Prakan 10540; tel 3128350-2; fax 3129353-4	ISO 14001	Manufacture of flexible disk drive (FDD)	BVQI 19-Mar-99
47	ReadRite (Thailand) Co., Ltd. 140 mu 2 Bang Pa-in IE., Ayutthaya 13160; tel (035)3501590; fax 350220	ISO 14001	Head gimbal assembly and slider fabrication	AJA EQS 3-Aug-96



48	ReadRite SMI (Thailand) Co., Ltd. 140 mu 2 Bang Pa-in IE., Ayutthaya 13160; tel (035) 3501590; fax 350220	ISO 14001	Head gimbal assembly and slider fabrication	AJA EQS 3-Aug-96
49	Lumphun Shindengen Co., Ltd. Northern Region Industrial Estate 105 Moo 4, Bangklang, Muang Lumphun , tel: 053 581406 ext. 1111, fax: 053-552-135	ISO 14001	The manufacture of electronic components i.e. Semiconductors, Switching Power Supply and Transformer, Photoconductor Drum	SGS 15-Jun-00
50	Lucent Technologies Microelectronics (Thailand) Ltd. Nawanakhon IE., 101/32-33 Phahonyothin Rd, Pathum Thani; tel 5290115.; fax 5291646	ISO 14001	Environmental management of site activities including assembly and test of integrated circuits in accordance with the publicly available Environmental Policy	LRQA 23-Jan-97
51	Saha Union PCL 336 mu 10, Bang Phra, Siracha, Chonburi 21210; tel (038) 341370-8; fax 341380	ISO 14001	Information not available	(CB not known) 29-Sep-97
52	Saha Union PCL (HDD) 336 mu 10 Bang Phra, Siracha, Chon Buri 20210; tel 038 341371-6; fax 341380	ISO 14001	Manufacture of head gimbal assembly, head stack assembly and hard disk drive	BVQI 28-Sep-98
53	Electronics Industry (USA) Co., Ltd. 103 Mu 4 Latkrabang EP2 Lampatiw, Ladkrabang Bangkok 10520 tel 3260540- 2, fax 3260934	ISO 14001	The manufacture of diodes, bridges, and surface mounting devices	SGS 19-Jan-00
54	NEC Technologies (Thailand) Co., Ltd. 60/76 mu 19 Nawanakhon IE, Khlong Nueng, Khlong Luang, Pathum Thani 12120; tel 5292467-76; fax 5292477	ISO 14001	Production of chip tantalum capacitor and thermal cutoff	JQA 4-Sep-98
55	NMB Precision Balls Ltd. 1 mu 7 Phahonyothin Rd km.51, Chiang Raknoi, Bangpa-in, Ayutthaya 13180; tel (035) 361503; fax 361477	ISO 14001	Information not available	(CB not known) 27-Oct-97
56	NMB Hi-tech Bearing Ltd. 1 mu 7 Phahonyothin Rd km.51, Chiang	ISO 14001	Information not available	(CB not known)

	Raknoi, Bangpa-in, Ayutthaya 13180; tel (035) 361503; fax 361477			27-Oct-97
57	NS Electronics Bangkok (1993) Ltd. 40/10 Sukhumvit 105, BKK; tel 3933126-5; fax 3937157	ISO 14001	Manufacture and testing of integrated circuits	AJA EQS 19-May-98
58	MF Industries Co., Ltd. 1/14 mu 5, Rojana IE, Khanham, Uthai, Ayutthaya 13210	ISO 14001	Information not available	(CB not known) 27-Oct-97
59	AMD Thailand Co., Ltd. 229 mu 4 Chaengwatthana Rd, Nonthaburi 1120	ISO 14001	Production of integrated circuit chips	TEI 8-Nov-99
60	LTEC Ltd and FPTT Ltd. 68/1 Moo 4,T. Ban Klang A. Muang, Lumphun 51000 Tel: (053) 581002-8, Fax: (053) 581010-11	ISO 14001	The manufacture of fiber optic components, drive and media, magnetic coil and membrane switches.	SGS 21-Jan-00
61	IBM Storage Products (Thailand) Co., Ltd. 203 mu 7 Thatum, Si Mahaphot, Pachinburi	ISO 14001	Manufacture of hard disk drive	BVQI 21-May-99



# Chapter 5

## Data Analysis

This chapter presents the surveyed results of data analysis and interpretation of findings in various topic issues. The purpose of this exploratory study is to examine the relationship between the cost incurred and the received benefit in implementing ISO14000. Data sources were collected the primary data through 43 questionnaires from target respondents. The data collection phase of this research is followed by data analysis of phase of research study.

**The entire data analysis part is divided into two parts, they are as follows :**

- I. Descriptive Analysis
- II. Inferential Statistics

*Descriptive Statistics* is a branch of statistics that provides researchers with summary measures for the data in their samples. The objective of descriptive statistics is to provide summary measures of the data contained in all the elements of a sample. In doing so the Measures of Central Tendency and Measures of Dispersion are usually concerned.

*Inferential Statistics* is also referred as the science of estimating population parameters from sample statistics (Davis and Cosenza, 1988). Furthermore, inferential statistics, based on probability theory and logic are used to make inferences about the characteristics of a random sample drawn from the population. In other words, inferential statistics involve the analysis and verification for hypothesis statements in the population, which are made to make inferences about the characteristic of the population.

### Part I : Descriptive Analysis

Descriptive Analysis is the method of preliminary data analysis that helps summarize the general nature of variables included in a study and the interrelations among them (Parasuraman, 1992). Descriptive analysis refers to the transformation of the raw data into a form that will make them easy to understand and interpret. Describing responses or observations is typically the first form of analysis, which is commonly done by calculating average score.

Of the 61 questionnaires mailed, forty-three questionnaires are received signifying a 70.49 % response rate, more than half of the total number of questionnaires mailed are returned by ISO 14001-certified companies of the electronics industry in Thailand.

Summary of Returned Questionnaires:

Table 5-1 : Summary of the questionnaires distributed and returned.

Questionnaires	Cases	Percent (%)
Questionnaire Distributed	61	100
Questionnaire Return Targeted	32	52.46
Questionnaire Return Achieved	43	70.49
Invalid Questionnaire	0	0
Total Valid Questionnaire Returned	43	70.49

From the table 5-1, it can be seen that there were 61 questionnaires distributed to the target Company in electronic industry in Thailand. A total of 43 questionnaires as 70.49% were collected more than a target questionnaires which have 32 questionnaires or 52.46%, the result was extremely satisfactory. 18 cases were unvalid because the questionnaires were not returned.

For the convenience of the reader this part of Descriptive Statistics is divided into two segments; those are as follows :

- 1. Average Score of All Activities on Cost-Benefit Analysis
- 2. Summary in Cost and Benefit Analysis

1. Average Score of All Activities on Cost-Benefit Analysis

1.1 The survey result of the perception of costs analysis

Table 5-2 : The scores of management system activity on the perception of cost analysis.

Activity	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Management System	43	3.32	Appropriate Costs

The average score of management system is identified in Table 5-2 on the basis perceptions of all the companies. It is shown that 3.32 scores of implementing ISO 14000 which is spent appropriate costs on this activity.



Table 5-3 : The scores of human resource management activity on the perception of cost analysis.

Activity	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Human Resource management	43	2.41	Low Costs

From Table 5-3 the result is showed that the perception of cost analysis from ISO 14000 implementation on human resource management was low costs. The average score is 2.41.

Table 5-4 : The scores of technology development activity on the perception of cost analysis.

Activity	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Technology Development	43	3.60	High Costs

Table 5-4 lists the average score from cost analysis on technology development, the average score of technology development is 2.75. It was obtained high costs for this activity in implementing ISO14000.

Table 5-5 : The scores of procurement activity on the perception of cost analysis.

Activity	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Procurement	43	2.34	Low Costs

The average score of procurement is identified in Table 5-5 on the basis perceptions of all the companies. It is shown that 2.34 scores of implementing ISO 14000 which is spent low costs on this activity.

Table 5-6 : The scores of operations activity on the perception of cost analysis.

Activity	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Operations	43	3.50	High Costs

From Table 5-6 the result is showed that the perception of cost analysis from ISO 14000 implementation on operations was high costs. The average score is 3.50.

Table 5-7 : The scores of inbound logistics activity on the perception of cost analysis.

Activity	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Inbound Logistics	43	3.09	Appropriate Costs

Table 5-7 lists the average score from cost analysis inbound logistics, the average score of inbound logistics is 3.09. It was obtained appropriate costs for this activity in implementing ISO14000.

Table 5-8 : The scores of outbound logistics activity on the perception of cost analysis.

Activity	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Outbound Logistics	43	3.04	Appropriate Costs

The average score of outbound logistics is identified in Table 5-8 on the basis perceptions of all the companies. It is shown that 3.04 scores of implementing ISO 14000 which is spent appropriate costs on this activity.



Table 5-9 : The scores of marketing and sales activity on the perception of cost analysis.

Activity	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Marketing and Sales	43	2.75	Appropriate Costs

From Table 5-9 the result is showed that the perception of cost analysis from ISO 14000 implementation on marketing and sales was appropriate costs. The average score is 2.75.

Table 5-10 : The scores of services activity on the perception of cost analysis.

Activity	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Services	43	3.39	Appropriate Costs

Table 5-10 lists the average score from cost analysis on services, the average score of services is 3.39. It was obtained appropriate costs for this activity in implementing ISO14000.

1.2 The survey result of the perception of benefits analysis

Table 5-11 : The scores of management system activity on the perception of benefit analysis.

Activity	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Management System	43	3.34	Appropriate Benefits

The average score of management system is identified in Table 5-11 on the basis perceptions of all the companies. It is shown that 3.34 scores of implementing ISO 14000 which is received appropriate benefits on this activity.

Table 5-12 : The scores of human resource management activity on the perception of benefit analysis.

Activity	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Human Resource Management	43	4.03	High Benefits

From Table 5-12 the result is showed that the perception of benefit analysis from ISO 14000 implementation on human resource management was high benefits. The average score is 4.03.

Table 5-13: The scores of technology development activity on the perception of benefit analysis.

Activity	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Technology Development	43	3.88	High Benefits

Table 5-13 lists the average score from benefit analysis on technology development, the average score of technology development is 3.88. It was obtained high benefits for this activity in implementing ISO14000.

Table 5-14 : The scores of procurement activity on the perception of benefit analysis.

Activity	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Procurement	43	3.27	Appropriate Benefits

The average score of procurement is identified in Table 5-14 on the basis perceptions of all the companies. It is shown that 3.27 scores of implementing ISO 14000 which is received appropriate benefits on this activity.



Table 5-15 : The scores of operations activity on the perception of benefit analysis.

Activity	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Operations	43	3.51	High Benefits

From Table 5-15 the result is showed that the perception of benefit analysis from ISO 14000 implementation on operations activity was high benefits. The average score is 3.51.

Table 5-16 : The scores of inbound logistics activity on the perception of benefit analysis.

Activity	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Inbound Logistics	43	3.27	Appropriate Benefits

Table 5-16 lists the average score from benefit analysis inbound logistics, the average score of inbound logistics is 3.27. It was obtained appropriate benefits for this activity in implementing ISO14000.

Table 5-17 : The scores of outbound logistics activity on the perception of benefit analysis.

Activity	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Outbound Logistics	43	3.05	Appropriate Benefits

The average score of outbound logistics is identified in Table 5-17 on the basis perceptions of all the companies. It is shown that 3.05 scores of implementing ISO 14000 which is received appropriate benefit on this activity.

Table 5-18 : The scores of marketing and sales activity on the perception of benefit analysis.

Activity	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Marketing and Sales	43	3.89	High Benefits

From Table 5-18 the result is showed that the perception of benefit analysis from ISO 14000 implementation on marketing and sales was high benefits. The average score is 3.89.

Table 5-19 : The scores of services activity on the perception of benefit analysis.

Activity	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Services	43	3.65	High Benefits

Table 5-19 lists the average score from benefit analysis on services, the average score of services is 3.65. It was obtained high benefits for this activity in implementing ISO14000.

1. Summary in Cost and Benefit Analysis

Summary of Descriptive Analysis on cost-benefit analysis for this study is represented by mean. It will be useful to summarize the series of observations. In this part the core of the Descriptive Analysis includes the mean and qualitative rating in table. These are the basic information from analysis result, which are presented in Appendix B.



Table 5-20 : The summary scores on the perception of cost analysis.

Activities	N	Cost Analysis (Independent Variable)	
		Mean	Qualitative Rating
Management System	43	3.32	Appropriate Costs
Human Resource Development	43	2.41	Low Costs
Technology Development	43	3.60	High Costs
Procurement	43	2.34	Low Costs
Operations	43	3.50	High Costs
Inbound Logistics	43	3.09	Appropriate Costs
Outbound Logistics	43	3.04	Appropriate Costs
Marketing and Sales	43	2.75	Appropriate Costs
Services	43	3.39	Appropriate Costs
Average Score	43	3.09	Appropriate Costs

From Table 5-20 the average score from costs analysis of all companies, it can be considered “Technology Development” received the highest average score during all of these activities and its score 3.60 points represent the costs of implementing EMS is high costs. “Operations” is shown in the second position and “Procurement” activity scores the least costs activities these are 3.50 and 2.34 respectively.

It can be seen that the average score of cost analysis all activities is about 3.09 points which are appropriate costs in implementing ISO 14000.

Table 5-21 : The summary scores on the perception of benefit analysis.

Activities	N	Benefit Analysis (Dependent Variable)	
		Mean	Qualitative Rating
Management System	43	3.34	Appropriate Benefits
Human Resource Development	43	4.03	High Benefits
Technology Development	43	3.88	High Benefits
Procurement	43	3.27	Appropriate Benefits
Operations	43	3.51	High Benefits
Inbound Logistics	43	3.27	Appropriate Benefits
Outbound Logistics	43	3.05	Appropriate Benefits
Marketing and Sales	43	3.89	High Benefits
Services	43	3.65	High Benefits
Average Score	43	3.52	High Benefits

Table 5-21 illustrates the average score from benefits analysis based on all of respondents. The average score of “Human Resource Development” activity is highest that is 4.03 points as high benefits after implementing ISO14000. The benefit in “Marketing and Sales” activity is stood in the second position, 3.89 scores that appear at high benefits. “Outbound Logistics” is shown in the last position with scores 3.05 or receiving appropriate benefits from ISO 14000 implementation result.

It can be seen that the average score of benefit analysis all activities is about 3.52 points which are high benefits in implementing ISO 14000.

## Part II Inferential Statistics

Hypotheses are numerical statements regarding the potential outcomes of an experiment (Grimm, 19993). A scientific hypothesis is a formal statement or expectation about the outcome of a study. Scientific hypothesis is usually stated in terms of Dependent and Independent variables, and a relation between them. When conducting a study, statistical hypotheses always come in pairs – a null hypotheses, denoted  $H_0$ , and an alternative hypothesis, denoted  $H_a$  in the context of an experiment, the null hypothesis states that there is no effect of the independent variable. The alternative hypothesis is the logical alternative to the null hypothesis. It is the alternative hypothesis that we hope that our research support since it is the statistical refinement of the research hypothesis.

### The Pearson Correlation Coefficient

The Pearson Correlation Coefficient is the most widely used measure of association in behavioral sciences research. The statistic takes its name from its developer, Karl Pearson, who officially named the statistic the Pearson product moment correlation coefficient, but it is more commonly referred to as the Pearson  $r$ . the Pearson  $r$  is appropriate for examining two interval or ratio level variables for evidence of a linear relationship.

### Interpretation of correlation coefficient

When the Pearson  $r$  is computed for a pair of variables, the resulting correlation coefficient will range between minus 1.00 and plus 1.00. The absolute value of the Pearson  $r$  and its sign (positive or negative) are each important pieces of information.

Possible range of the Pearson  $r = (-1.00 \leq r \leq 1.00)$

The sign of the Pearson  $r$  indicates the direction or type of relationship between the two variables. A positive Pearson  $r$  indicates a positive relationship; that is, as the independent variable increases, there will be a corresponding increase in the dependent variable. A negative Pearson  $r$  indicates a negative relationship, meaning that an increase in the independent variable results in a corresponding decrease in the dependent variable. A correlation coefficient equal to zero indicates no relationship between the two variables.



The absolute value of the correlation coefficient indicates the strength of the relationship between the two variables. The absolute value of the correlation coefficient will equal 1.00. The correlation coefficient of +1.00 indicates a perfect positive relationship and a correlation coefficient of -1.00 indicates a perfect negative relationship.

Test of significant and significant level

Two-tailed test is employed because the direction of association cannot be determined in advance. Correlation coefficient significant at the 0.05 confidence level is used in this research. It is identified with a single asterisk, and those significant at the 0.01 level are identified with two asterisks in case of there being more relations.

Guidelines for interpretation of correlation coefficients

$\pm r$	Strength of Relationship
0.75-1.00	Strong
0.50-0.74	Moderate to high
0.25-0.49	Low to moderate
0.00-0.24	Weak

Hypothesis 1

- H1o : Benefit is not higher than the cost of implementing management system due to ISO14000.
- H1a : Benefit is higher than the cost of implementing management system due to ISO14000.

Or it can be stated in statistical terms as:

- H1o :  $r = 0$
- H1a :  $r \neq 0$ , 95% level of significance ( $\alpha = 0.05$ )

Correlation

		CSMANAGE	BSMANAG
CSMANAGE	Pearson Correlation	1.000	.853
	Sig. (2-tailed)	.	.000
	N	43	43
BSMANAG	Pearson Correlation	.853	1.000
	Sig. (2-tailed)	.000	.
	N	43	43

\*\* Correlation is significant at the 0.01 level (2-tailed).

**Significant level** (2-tailed test) shows the value of 0.000, which is less than the set criteria of  $\alpha = 0.05$  providing that the null H1o is completely to be rejected, while the alternative H1a is accepted and will be supportive to the theory finally.

**Correlation coefficient (r)** indicates the value of 0.852 it means that there is a positive relationship between cost of ISO14000 implementation in management system and benefits in management system due to ISO14000 at the significant correlation level of 0.01 or accurately 99% level of significance.

The result above indicates that there is some positive relationship between cost of ISO14000 implementation in management system and benefits in management system due to ISO14000 with correlation coefficient of 0.852. The correlation coefficient shows that the relationship is strong (it is between 0.75-1.00). According to the significant level at 0.000 which is less than the set criterion  $\alpha = 0.05$ , **therefore, the null hypothesis (H1o) is rejected while accepting (H1a)**. The result supports the alternative hypothesis thus the result of the test reveals the fact that high cost of ISO14000 implementation in management system reflects high benefits in management system due to ISO14000.

**Hypothesis 2**

H2o : Benefit is not higher than the cost of implementing human resource management due to ISO14000.

H2a : Benefit is higher than the cost of implementing human resource management due to ISO14000.

Or it can be stated in statistical terms as:

H2o :  $r = 0$

H2a :  $r \neq 0$ , 95% level of significance ( $\alpha = 0.05$ )

**Correlation**

		CSHUMAN	BSHUMAN
CSHUMAN	Pearson Correlation	1.000	-.812
	Sig. (2-tailed)	.	.000
	N	43	43
BSHUMAN	Pearson Correlation	-.812	1.000
	Sig. (2-tailed)	.000	.
	N	43	43

\*\* Correlation is significant at the 0.01 level (2-tailed).

**Significant level** (2-tailed test) shows the value of 0.000, which is less than the set criteria of  $\alpha = 0.05$  providing that the null H2o is completely to be rejected, while the alternative H2a is accepted and will be supportive to the theory finally.



**Correlation coefficient (*r*)** indicates the value of -0.812 it means that there is a negative relationship between cost of ISO14000 implementation in human resource management and benefits in human resource management due to ISO14000 at the significant correlation level of 0.01 or accurately 99% level of significance.

The result above indicates that there is opposite relationship between cost of ISO14000 implementation in human resource management and benefits in human resource management due to ISO14000 with correlation coefficient of -0.812. The correlation coefficient shows that the relationship is strong (it is between 0.75-1.00). According to the significant level at 0.000 which is less than the set criterion  $\alpha = 0.05$ , **therefore, the null hypothesis (H2o) is rejected while accepting (H2a).** The result supports the alternative hypothesis thus the result of the test reveals the fact that low cost of ISO14000 implementation in human resource management reflects high benefits in human resource management due to ISO14000.

**Hypothesis 3**

H3o : Benefit is not higher than the cost of implementing technology development due to ISO14000.

H3a : Benefit is higher than the cost of implementing technology development due to ISO14000.

Or it can be stated in statistical terms as:

H3o :  $r = 0$

H3a :  $r \neq 0$ , 95% level of significance ( $\alpha = 0.05$ )

Correlation

		CSTECH	BSTECH
CSTECH	Pearson Correlation	1.000	.769
	Sig. (2-tailed)	.	.000
	N	43	43
BSTECH	Pearson Correlation	.769	1.000
	Sig. (2-tailed)	.000	.
	N	43	43

\*\* Correlation is significant at the 0.01 level (2-tailed).

**Significant level** (2-tailed test) shows the value of 0.000, which is less than the set criteria of  $\alpha = 0.05$  providing that the null H3o is completely to be rejected, while the alternative H3a is accepted and will be supportive to the theory finally.

**Correlation coefficient ( $r$ )** indicates the value of 0.769 it means that there is a positive relationship cost of ISO14000 implementation in technology development and benefits in technology development due to ISO14000 and at the significant correlation level of 0.01 or accurately 99% level of significance.

The result above indicates that there is some positive relationship between cost of ISO14000 implementation in technology development and benefits in technology development due to ISO14000 with correlation coefficient of 0.769. The correlation coefficient shows that the relationship is strong (it is between 0.75-1.00). According to the significant level at 0.000 which is less than the set criterion  $\alpha = 0.05$ , **therefore, the null hypothesis (H3o) is rejected while accepting (H3a)**. The result supports the alternative hypothesis thus the result of the test reveals the fact that high cost of ISO14000 implementation in technology development reflects high benefits in technology development due to ISO14000.

#### Hypothesis 4

H4o : Benefit is not higher than the cost of implementing procurement due to ISO14000 .

H4a : Benefit is higher than the cost of implementing procurement due to ISO14000.

Or it can be stated in statistical terms as:

H4o :  $r = 0$

H4a :  $r \neq 0$ , 95% level of significance ( $\alpha = 0.05$ )

#### Correlation

		CSPROCU	BSPROCU
CSPROCU	Pearson Correlation	1.000	.282
	Sig. (2-tailed)	.	.000
	N	43	43
BSPROCU	Pearson Correlation	.282	1.000
	Sig. (2-tailed)	.000	.
	N	43	43

\*\* Correlation is significant at the 0.01 level (2-tailed).

**Significant level (2-tailed test)** shows the value of 0.000, which is less than the set criteria of  $\alpha = 0.05$  providing that the null H4o is completely to be rejected, while the alternative H4a is accepted and will be supportive to the theory finally.

**Correlation coefficient ( $r$ )** indicates the value of 0.282 it means that there is a positive relationship between cost of ISO14000 implementation in procurement and benefits in procurement due to ISO14000 the significant correlation level of 0.01 or accurately 99% level of significance.



The result above indicates that there is some positive relationship between cost of ISO14000 implementation in procurement and benefits in procurement due to ISO14000 with correlation coefficient of 0.282. The correlation coefficient shows that the relationship is low to moderate (it is between 0.25-0.49). According to the significant level at 0.000 which is less than the set criterion  $\alpha = 0.05$ , **therefore, the null hypothesis (H4o) is rejected while accepting (H4a)**. The result supports the alternative hypothesis thus the result of the test reveals the fact that low costs of ISO14000 implementation in procurement reflect low benefits in procurement due to ISO14000.

### Hypothesis 5

H5o : Benefit is not higher than the cost of implementing inbound logistics due to ISO14000.

H5a : Benefit is higher than the cost of implementing inbound logistics due to ISO14000.

Or it can be stated in statistical terms as:

H5o :  $r = 0$

H5a :  $r \neq 0$ ,     95% level of significance ( $\alpha = 0.05$ )

Correlation

		CPOPER	BPOPER
CPOPER	Pearson Correlation	1.000	.642
	Sig. (2-tailed)	.	.000
	N	43	43
BPOPER	Pearson Correlation	.642	1.000
	Sig. (2-tailed)	.000	.
	N	43	43

\*\* Correlation is significant at the 0.01 level (2-tailed).

**Significant level** (2-tailed test) shows the value of 0.000, which is less than the set criteria of  $\alpha = 0.05$  providing that the null H4o is completely to be rejected, while the alternative H4a is accepted and will be supportive to the theory finally.

**Correlation coefficient (r)** indicates the value of 0.642 it means that there is a positive relationship between cost of ISO14000 implementation in operations and benefits in operation due to ISO14000 the significant correlation level of 0.01 or accurately 99% level of significance.

The result above indicates that there is some positive relationship between cost of ISO14000 implementation in operations and benefits in operation due to ISO14000 with correlation coefficient of 0.642. The correlation coefficient shows that the relationship is moderate to high (it is between 0.50-0.74). According to the significant level at 0.000 which is less than the set criterion  $\alpha = 0.05$ , **therefore, the null**

**hypothesis (H4o) is rejected while accepting (H4a).** The result supports the alternative hypothesis thus the result of the test reveals the fact that moderate costs of ISO14000 implementation in operations reflect moderate benefits in operations due to ISO14000.

**Hypothesis 6**

H6o : Benefit is not higher than the cost of implementing operations due to ISO14000.

H6a : Benefit is higher than the cost of implementing operations due to ISO14000.

Or it can be stated in statistical terms as:

H6o :  $r = 0$

H6a :  $r \neq 0$ , 95% level of significance ( $\alpha = 0.05$ )

**Correlation**

		CPINBO	BPINBO
CPINBO	Pearson Correlation	1.000	.334
	Sig. (2-tailed)	.	.000
	N	43	43
BPINBO	Pearson Correlation	.334	1.000
	Sig. (2-tailed)	.000	.
	N	43	43

\* Correlation is significant at the 0.05 level (2-tailed).

**Significant level** (2-tailed test) shows the value of 0.000, which is less than the set criteria of  $\alpha = 0.05$  providing that the null H6o is completely to be rejected, while the alternative H6a is accepted and will be supportive to the theory finally.

**Correlation coefficient ( $r$ )** indicates the value of 0.334 it means that there is a positive relationship between cost of ISO14000 implementation in inbound logistics and benefits in inbound logistics due to ISO14000 at the significant correlation level of 0.05 or accurately 95% level of significance.

The result above indicates that there is some positive relationship between cost of ISO14000 implementation in inbound logistics and benefits in inbound logistics due to ISO14000 with correlation coefficient of 0.334. The correlation coefficient shows that the relationship is low to moderate (it is between 0.25-0.49). According to the significant level at 0.000 which is less than the set criterion  $\alpha = 0.05$ , **therefore, the null hypothesis (H6o) is rejected while accepting (H6a).** The result supports the alternative hypothesis thus the result of the test reveals the fact that low cost of ISO14000 implementation in inbound logistics reflects low benefits in inbound logistics due to ISO14000.



Hypothesis 7

H7o : Benefit is not higher than the cost of implementing outbound logistics due to ISO14000.

H7a : Benefit is higher than the cost of implementing outbound logistics due to ISO14000.

Or it can be stated in statistical terms as:

H7o :  $r = 0$

H7a :  $r \neq 0$ , 95% level of significance ( $\alpha = 0.05$ )

Correlation

		CPOUTB	BPOUTB
CPOUTB	Pearson Correlation	1.000	.356
	Sig. (2-tailed)	.	.019
	N	43	43
BPOUTB	Pearson Correlation	.356	1.000
	Sig. (2-tailed)	.019	.
	N	43	43

\* Correlation is significant at the 0.05 level (2-tailed).

**Significant level** (2-tailed test) shows the value of 0.019, which is less than the set criteria of  $\alpha = 0.05$  providing that the null H7o is completely to be rejected, while the alternative H7a is accepted and will be supportive to the theory finally.

**Correlation coefficient ( $r$ )** indicates the value of 0.356 it means that there is a positive relationship between cost of ISO14000 in outbound logistics and benefits in outbound logistics due to ISO14000 at the significant correlation level of 0.05 or accurately 95% level of significance.

The result above indicates that there is some positive relationship between cost of ISO14000 implementation in outbound logistics and benefits in outbound logistics due to ISO14000 with correlation coefficient of 0.356. The correlation coefficient shows that the relationship is low to moderate (it is between 0.25-0.49). According to the significant level at 0.019 which is less than the set criterion  $\alpha = 0.05$ , **therefore, the null hypothesis (H7o) is rejected while accepting (H7a)**. The result supports the alternative hypothesis thus the result of the test reveals the fact that low cost of ISO14000 implementation in outbound logistics reflects low benefits in outbound logistics due to ISO14000.

Hypothesis 8

H8o : Benefit is not higher than the cost of implementing marketing and sales due to ISO14000.

H8a : Benefit is higher than the cost of implementing marketing and sales due to ISO14000.

Or it can be stated in statistical terms as:

H8o :  $r = 0$   
H8a :  $r \neq 0$ , 95% level of significance ( $\alpha = 0.05$ )

Correlation

		CPMARK	BPMARK
CPMARK	Pearson Correlation	1.000	.682
	Sig. (2-tailed)	.	.000
	N	43	43
BPMARK	Pearson Correlation	.682	1.000
	Sig. (2-tailed)	.000	.
	N	43	43

\*\* Correlation is significant at the 0.01 level (2-tailed).

**Significant level** (2-tailed test) shows the value of 0.000, which is less than the set criteria of  $\alpha = 0.05$  providing that the null H8o is completely to be rejected, while the alternative H8a is accepted and will be supportive to the theory finally.

**Correlation coefficient (r)** indicates the value of 0.682 it means that there is a positive relationship between cost of ISO14000 implementation in marketing and sales and benefits in marketing and sales due to ISO14000 at the significant correlation level of 0.01 or accurately 99% level of significance.

The result above indicates that there is some positive relationship between cost of ISO14000 implementation in marketing and sales and benefits in marketing and sales due to ISO14000 with correlation coefficient of 0.682. The correlation coefficient shows that the relationship is moderate to high (it is between 0.50-0.74). According to the significant level at 0.000 which is less than the set criterion  $\alpha = 0.05$ , **therefore, the null hypothesis (H8o) is rejected while accepting (H8a)**. The result supports the alternative hypothesis thus the result of the test reveals the fact that high cost of ISO14000 implementation in marketing and sales reflects high benefits in marketing and sales due to ISO14000.



Hypothesis 9

H9o : Benefit is not higher than the cost of implementing service due to ISO14000 .

H9a : Benefit is higher than the cost of implementing service due to ISO14000 .

Or it can be stated in statistical terms as:

H9o :  $r = 0$

H9a :  $r \neq 0$ , 95% level of significance ( $\alpha = 0.05$ )

Correlation

		CPSERV	BPSEV
CPSERV	Pearson Correlation	1.000	.206
	Sig. (2-tailed)	.	.000
	N	43	43
BPSEV	Pearson Correlation	.206	1.000
	Sig. (2-tailed)	.000	.
	N	43	43

\* Correlation is significant at the 0.05 level (2-tailed).

**Significant level** (2-tailed test) shows the value of 0.000, which is less than the set criteria of  $\alpha = 0.05$  providing that the null H7o is completely to be rejected, while the alternative H7a is accepted and will be supportive to the theory finally.

**Correlation coefficient ( $r$ )** indicates the value of 0.206 it means that there is a positive relationship between cost of ISO14000 implementation in service and benefits in service due to ISO14000 at the significant correlation level of 0.05 or accurately 95% level of significance.

The result above indicates that there is some positive relationship between cost of ISO14000 implementation in service and benefits in service due to ISO14000 with correlation coefficient of 0.206. The correlation coefficient shows that the relationship is low to moderate (it is between 0.25-0.49). According to the significant level at 0.000 which is less than the set criterion  $\alpha = 0.05$ , **therefore, the null hypothesis (H7o) is rejected while accepting (H7a)**. The result supports the alternative hypothesis thus the result of the test reveals the fact that low cost of ISO14000 implementation in service reflects low benefits in service due to ISO14000.

## Chapter 6

### Conclusion and recommendation

#### Conclusion

In above, the cost-benefit analyses of implementing EMS were analyzed in electronic companies to find out the basic situation of implementing ISO14001 in Thailand. All of interviews were conducted at a Thai company, which are already certified ISO 14001. The conclusion of perception costs and benefits for implementing ISO14001 in Thailand were represented in this chapter.

In this research, using questionnaire as the research instrument for collecting the primary data 43 copies of questionnaires are completed by the target population in electronic company. This research is a quantitative research that present the data analysis in tabulation form by using descriptive analysis to explain its average score in each activity. Brivariate test is used to test the correlation coefficient in the 9 set of hypotheses.

The costs and benefits analysis in this study is based on the perceptions of every interviewee in the selected companies. It is not the real cost-benefit analysis but the perception of cost-benefits. What the results have been shown in this study is the reflection of the perceptions. Even through the perception of every company is based on the different background, the general characteristics are similar according to the findings.



6.1 The perception of cost-benefit activities in implementing ISO 14000 EMS.

According to the first objective, the research has been designed to demonstrate the perception of cost and benefit in each activity that relate the implementation of ISO 14000 EMS.

Table 6-1 Average score of each activity on cost-benefit analysis

Activities	Cost Analysis	Benefit Analysis
Management System	3.32	3.34
Human Resource Management	2.41	4.03
Technology Development	3.60	3.88
Procurement	2.34	3.27
Operations	3.50	3.51
Inbound Logistics	3.09	3.27
Outbound Logistics	3.04	3.05
Marketing and Sales	2.75	3.89
Services	3.39	3.65
Average Score	3.09	3.52

The average score results of cost and benefit analysis of these 43 companies are shown in Table 6-1, which is based on the questionnaire (see Appendix A). The technical manager of each company, who is the leader in the company for implementing EMS, answered questionnaires.

Each activity has a number of different content areas. Therefore, the average score has been used in order to analyze each activity at the same basis. Through the comparisons of costs and benefits within every company, it is evident that average scores of benefits are higher than costs. The common characteristic of 43 companies is appropriate costs or 3.09 scores in proportion to high benefits with 3.52 scores. The research found that, even though at the initial stage, the investments of technology development and operations use high costs, whereas the score of benefits by average almost high like in human resource management, technology development, operations, marketing and sales, and services.

Implementing ISO14000 is a long-term activity, its cost-benefit analysis should also be viewed in a long-term sight. It can be said that, on the long-term point of view, the benefits of implementing ISO14000 cover costs in electronic company.

### 6.2 The relationship of cost-benefit analysis in implementing ISO14000 EMS.

According to the second objective, the research has been designed to find the relationship of costs and benefits in each variable that is influent the implementation of ISO14000 EMS. After the bivariate correlation analysis, most of factors considered were found to be relevant and the summary of the hypothesis tests with the level of significance and level of strength of the relationship are presented below.

Table 6-2 : Summary of hypotheses testing result

Hypothesis	Statistics Test	Significant Value	Correlation Coefficient	Result
H1a : Benefit is higher than the cost of implementing management system due to ISO14000.	Bivariate Test	0.000	0.852**	Reject Ho
H2a : Benefit is higher than the cost of implementing human resource management due to ISO14000.	Bivariate Test	0.000	-0.812**	Reject Ho
H3a : Benefit is higher than the cost of implementing technology development due to ISO14000.	Bivariate Test	0.000	0.769**	Reject Ho
H4a : Benefit is higher than the cost of implementing procurement due to ISO14000.	Bivariate Test	0.000	0.282**	Reject Ho
H5a : Benefit is higher than the cost of implementing inbound logistics due to ISO14000.	Bivariate Test	0.000	0.642**	Reject Ho
H6a : Benefit is higher than the cost of implementing operations due to ISO14000.	Bivariate Test	0.000	0.334*	Reject Ho



H7a : Benefit is higher than the cost of implementing outbound logistics due to ISO14000.	Bivariate Test	0.019	0.356*	Reject Ho
H8a : Benefit is higher than the cost of implementing marketing and sales due to ISO14000.	Bivariate Test	0.000	0.682**	Reject Ho
H9a : Benefit is higher than the cost of implementing service due to ISO14000 .	Bivariate Test	0.000	0.206*	Reject Ho

\*\* : Correlation is significant at the 0.01 level (2-tailed)

\* : Correlation is significant at the 0.05 level (2-tailed)

Of the nine hypotheses tested for the existence of the relationships between independent variable(cost) and dependent variable(benefit). Most of them appeared to bear significant relationship based on the analysis of the data accumulated from the ISO14001-certified companies in the electronics industry of Thailand. In other words, most null hypotheses (Ho) are rejected as a result of the correlation test; whereas one null hypothesis has the opposite relationship.

The result of testing of the relationship hypotheses at 95 percent confident level indicate following

**1. Benefit is higher than the cost of implementing management system due to ISO14000.**

The costs incurred from ISO14000 implementation in management system relates to benefits received in management system from implementing ISO14000. Due to the high costs from building up the system, development of an environmental management documents, auditing the system, and certifying the system make for the high benefits in a good public image, better relations with communities and green groups, attracting shareholders, and more efficiency and security due to environmental management handbook. Moreover, the average score of descriptive analysis shown that benefit is higher than the cost of implementing management system due to ISO14000.

**2. Benefit is higher than the cost of implementing human resource management due to ISO14000.**

The costs incurred from ISO14000 implementation in human resource management has a few due to building up awareness of employees and training education it does not need costs a lot. In contrast, the benefits received in human resource management due to ISO14000 is higher staff commitment and better labor relations and increase awareness of employees who transfer benefits to other activities. Therefore, the relationship is negative during the correlation test in the implementation EMS based on ISO 14000 standard. Moreover, the average score of descriptive analysis shown that benefit is higher than the cost of implementing human resource management due to ISO14000.

**3. Benefit is higher than the cost of implementing technology development due to ISO14000.**

The costs incurred from ISO14000 implementation in technology development relates to benefits received in technology development from implementing ISO14000. Because the initial costs from technological investment, redesigned products, and redesigned production process are quite high. However, companies can develop and apply these new technologies in order to increase efficient working to companies in the long-term. Consequently, companies will get high benefits from these activities. Moreover, the average score of descriptive analysis shown that benefit is higher than the cost of implementing technology development due to ISO14000.

**4. Benefit is higher than the cost of implementing procurement due to ISO14000.**

The costs incurred from ISO14000 implementation in procurement activity relates to benefit received from implementation ISO 14000 on this activity in low level. Due to



the cost incurred from ISO 14000 implementation in new procurement is spent a few costs while the benefits are received in appropriate level (see in the result of descriptive analysis). Therefore, the result is shown that the relation is low level. Moreover, the average score of descriptive analysis shown that benefit is higher than the cost of implementing procurement due to ISO14000.

**5. Benefit is higher than the cost of implementing inbound logistics due to ISO14000.**

The costs incurred from ISO14000 implementation in operations activity relates to benefit received from implementation ISO 14000 on this activity in moderate level. That means the perceptions of respondents in cost incurred such as pollution abatement technology and waste separation is spent appropriately with benefit received on this activity. Moreover, the average score of descriptive analysis shown that benefit is higher than the cost of implementing inbound logistics due to ISO14000.

**6. Benefit is higher than the cost of implementing operations due to ISO14000.**

As a result, the respondents' perception show that the costs incurred from ISO14000 implementation in inbound logistics activity has the relationship in low level with benefit received from implementation ISO 14000. Moreover, the average score of descriptive analysis shown that benefit is higher than the cost of implementing operation due to ISO14000.

**7. Benefit is higher than the cost of implementing outbound logistics due to ISO14000.**

The costs incurred from ISO14000 implementation in outbound logistics activity has the relationship in low level with benefit received from implementation ISO 14000. Due to the used cost in distributing products to buyers that it may be high or low level depend on distance or others but the benefits received from this activity is perceived appropriate level (see in the result of descriptive analysis). Therefore, the relationship in outbound logistics is low level. Moreover, the average score of descriptive analysis shown that benefit is higher than the cost of implementing outbound logistics due to ISO14000.

**8. Benefit is higher than the cost of implementing marketing and sales due to ISO14000.**

The high costs incurred from ISO 14000 implementation in marketing and sales such as communication costs, labeling costs, and promotion costs relates to benefits received in this activity. Due to the trend of demand in the marketplace for "green products" is popular both local and global companies therefore, the benefits received in this activity is also high such as increased marketed share due to product

innovation, accessed to foreign markets and increased demand. Moreover, the average score of descriptive analysis shown that benefit is higher than the cost of implementing marketing and sales due to ISO14000.

## **9. Benefit is higher than the cost of implementing service due to ISO14000 .**

The costs incurred from ISO14000 implementation in service activity has the relationship in low level with benefit received from implementation ISO 14000. Due to the benefits received from repairing and upgrade service to open new markets is quite high level but costs are perceived in appropriate level (see in the result of descriptive analysis). Therefore, the relationship between the cost incurred and benefit received is not quite related or the relation is low level. Moreover, the average score of descriptive analysis shown that benefit is higher than the cost of implementing service due to ISO14000.

## **Recommendations**

### **1. The result recommendations**

#### **The positive relationship : ( high costs, high benefits )**

It will be both high costs and high benefits or low costs and low benefits. Cost incurred is a major factor in implementing ISO 14000. In implementing ISO 14000, the initial cost in some activities may be high costs like the operations activity and technology development activity due to adaptation the new system which is required redesigning products and process, documentation, building up the system, auditing the system, waste separation, implementing of the new procurement, storage cost and others. These factors are required to be based on the new system in the ISO 14000. Although the initial cost of implementing ISO 14000 is high, the benefits received is also maximum benefits such as technology development which can be increased productivity, reduced charges, and lower waste cost.

In contrast, if companies spend a little budget/no budget in each activity of implementing ISO 14000, the benefits received may not be got fully, for example, there are old machine which still use in process the productivity is 50 pieces/day. In opposite way, if companies buy a new machine, which receives 60 pieces/day, they can obtain higher benefits than the old machine. Implementing ISO 14000 is a long-term activity, which the benefit received may be occurred in a long-term sight.

In addition, the positive relationship has the advantages for managers at first step because they can plan the budget in implementing ISO 14000 which activity should spend more cost and some activities should use less costs in order to budget plan used the most value. Most organizations will be incurring the initial costs but it should be a long-term reduction in environmental costs.



### **The negative relationship : (low costs, high benefits)**

Respondents were conducted at 43 companies. Most of them were certified for ISO 9000 first before implementing ISO 14000. The previous experiences and existing practices based on ISO 9000 standard have the influence in the new system on the implementation ISO 14000(Lacoul, 1999).

Therefore in some activities such as human resource management ; most companies emphasize on well managed in human resource to increase employees' performance and foster their commitment to the company. Training and development and motivation are the key factors within this function. These factors are rated to benefit by human resource function, companies can obtain a lot of experiences from previous standard which will help save cost for training employees or some company maybe provide a video presentation to its employees at any time. From most reasons, they can reduce the cost incurred and obtain huge benefits on the human resource management activity due to human resource management activity it is the important activity of company because it can link to other activities in company.

It can be identified that human resource management activities do not need to spend more costs in implementing ISO 14000 and the perception of benefit received it can cover cost. Moreover, if companies spent more money in this activity, it may be unnecessary in this activity.

Actually, it is difficult in order to measure costs and benefits in each activity because companies are networks of activities, connected by linkages occur when the way in which one activity is performed affects the cost or effectiveness of other activities. For example, a more costly product design, more expensive components, and more thorough inspection can reduce after-sale service costs.

Coordinating linked activities reduces transaction costs, allows better information for control purposes, and substitutes less costly operations in one activity for more costly ones elsewhere.

For this thesis, it is researched to identify each activity which one should spend more costs to receive most benefit or which activity does not need high costs but it can occur huge benefit.

## **2. General Recommendations**

There recommendation are based on discussion had with managers of various organizations.

## **2.1 EMS does not exist only on paper but is involved with people**

EMS is a system, which requires a company not only to comply with relative environmental standards, but also to continuously improve their environment. Obtaining certification is not the main purpose. The main purpose of implementing ISO14001 from a company's point of view is to address environmental protection and prevention of pollution in balance with social-economic needs. The people in a company have a vital role to play in ensuring that it can meet its environmental obligations. It is important for a company to allow staff to be fully involved in its environmental programs, and to harness their enthusiasm and innovation. That which has been written on paper reflects only the system itself; the more important thing is how to put the system into action to be environmentally friendly. This involves with people. Over documentation should be overcome in implementing ISO 9000 as well as ISO14001.

## **2.2 Maintaining EMS is much more difficult than implementing the system**

Implementing EMS is important, but maintaining the system and continuously improving effects on the environment are much more important, and much more difficult. Most managers should realize how to maintain this system that has still been and got the advantages in order to make more profits from implementing ISO14000.

## **2.3 Strong support from government is necessary**

- In a newly industrialized country like Thailand, government support is very important for companies to implement ISO14001. Small and medium size companies have difficulties implementing ISO 14001 in a short time without help from outside. Difficulties will even occur in some large companies in newly industrialized countries (NICs) because they have not been concerned about the environment for a long time. What much change is not only the culture of these companies, but also the production processes or the products themselves. To solve these kinds of problems, strong support and pressure from governments will be needed. This is required to reinforce the infrastructure of the entire country in terms of promotion, environmental regulations and financial support.

Moreover, the Thai government should realize that the Thai citizens are demanding for ISO14000. And if the Thai government is seeking to increase green consumerism, it should support the consumers as proven necessary. For example, the very proactive Korean government has passed a law to encourage the industry to implement ISO14000, and the Japanese government is incorporating ISO14000 as a part of Japanese industrial standard. Since only half of the population perceives that ISO14000 will ensure environmental law compliance. And about half of the population use ISO14000 as a purchasing



factor. The Thai government can get better cooperation in environmental protection and pollution prevention from organizations.

- Promoting the implementation of environmental management system. The Thai government can increase the growth of environmental management system in domestic companies by giving incentives to them. The incentives can be in the form of tax refunds. This tax refund would have to be significant enough to be relatively attractive when compared to the overall cost of implementing the environmental management system (initial startup cost and returning cost). Therefore this tax refund rate would be different for different industries. The industries that have more potential in creating an environmental hazard would be in need of more capital to implement the environmental management system. For example, a pulp and paper manufacturer would need more capital than a magazine printer, since the pulp and paper manufacturer are dealing with major waste water treatment plants which has to be treated internally. While the printer are dealing with ink and waste paper disposal. The pump and paper manufacturers would need more intencives than the printers. Even though there are environmental laws and regulation in place, the environmental laws in Thailand are somehow bypassed, therefore this certain incentive is need.
- Increase green consumerism through publicity. The Thai government can boost the growth of green consumerism through publicity campaigns. Television, radio, paper media and conferences are just some examples. From the research up to 80% of the population want companies to implement ISO14000 but only 50% will consider buying those products (Terasart, 1999). Through publicity, understanding of environmental management systems will improve. With improved understanding of the environmental management system, the consumers will feel more confident and comfortable about environmental management systems, which in turn should raise the number of population that actually purchases the product from environmentally certified manufacturers. The publicity or advertisement should comprise of the purpose of environmental management system, the environmental benefit and the consumers' benefit from the environmental management system. The media should be simplified, easy to understand and remember for maximum impression and also stress that it is everybody's duty to take care of the environment. The Thai government can start with the result from this research, that is using the identified expectation that consumers are expecting to see as the key point to attract attention. Then continue providing information on other main features and benefits of the environmental management system. Eventually consumer would have knowledge on environmental management systems and optimistically they will become a green consumer.

## 2.4 Thai academic system.

The Thai academic system should include a course in environmental management system in the undergraduate, graduate level or even an introduction session in high school level, in order to raise the level of understanding of the benefits of environmental management systems. Since as it is found in this research that costs are related to the benefits in each activity in an environmental management system, if the prospect have knowledge on environmental management systems they would likely to believe in one and support it.

## 2.5 Benefits for other companies

- The design of ISO9000 and ISO14001 can be said to be compatible. Because of the similarities of these two standards, it is said that “an ISO9000 certified company is 70 percent of the way to ISO14001” (Terasart, 1999). Lots of companies have recognized the importance of ISO9000 and believe they are capable of receiving ISO9000 certification, but are still in doubt about ISO14001. It is a wise decision for these companies to try to obtain ISO9000 first and then to consider ISO14001 when the time is ripe for them.
- For companies that want to demonstrate to the society that they are a part of the society and are concerned and responsible for the well being of the environment can do so with an ISO14000 certification. Since the standard is voluntary and will help companies manage and evaluate their environmental impacts in a preventive manner. They would respect the ISO14000 certificate possessed by the company. The research also reveal that three forth of the population believe that ISO14000 will ensure a company’s concern for the environment and half of the population perceive that ISO14000 will ensure that the certified company complies to environmental laws and regulations. The standard should be of special interest to small businesses, since ISO14000 will assist them in dealing with the complexity of environmental laws and regulations.
- For companies that want to improve the relationship between the company and the work force. By having an ISO14000 certificate, may reduce the company workforce conflict. People wish to work for ethical and responsible companies and companies that demonstrate environmental concern to the public should find it easier to attract, retain and motivate the workforce. When the workforce are impressed with the effort to obtain or the certification itself, the workforce’s perception should change.



### 3 Recommendation for further research

This research can be further in several directions in order to encompass a wider vicinity of the factors associates with the implementation of ISO14000 EMS. The following are the myriad consideration to be made in order to forward this research.

- The study can expand to broader scope. The research can be conducted in different industries instead of electronic industry only. And the study also can expand to other countries instead of Thailand only. With this, the differences could be seen among different industries, and different countries in ISO14000 certification. Increasing the sample size will help in illustration the situations with more solid base.
- Future research can study more than identified internal benefit activities in this research. Open-end questionnaires may help to find out more factors affecting ISO14000 certification. And researcher can try to use different measurement of success such as customer's satisfaction, organization's performance and so on.
- Future study can go deeper to focus on one of the specific issues. Deeper discussion will help to have better understanding of that specific issue. Such as how each specific factor affect the ISO14000 certification.
- Further research on ISO14000. As ISO14000 has become another important aspect in the modern global business, the research can be done with the aim to help companies integrate ISO14000 in the ISO9000 quality system.
- This research can be diverted to some extent to apprehend the benefits and incentives that drive organizations to pursue the ISO14000 EMS implementation.
- Further research can study that the benefit received in implementing ISO 14000 can cover the whole costs incurred from ISO14000 implementation. It will be benefits for company which are not implementing ISO 14000 yet by identifying the real data for them.

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# APPENDIX







Graduate School of Business, Assumption University

มหาวิทยาลัยอัสสัมชัญ

TO WHOME IT MAY CONCERN

This letter is issued to certify that Miss Nattawadee Kositapa student I.D Code. 413-9079 is a graduate student in the Graduate School of Business of Assumption University. Presently Miss Nattawadee is doing her thesis entitled "*An Investigation into the Perceptive cost-benefit Analysis of Implementing ISO 14000*". As part of her research, she has to conduct a field study to collect primary data on the perception of you in your company.

She has selected your company that is strongly in the market as part of her research. In order to ensure Miss Nattawadee's endeavor towards a knowledgeable piece of research work. I would appreciate your company's cooperation as to the access to your customers and staffs. Please be assured this is an academic exercise and any such findings resulting from this research will not be disclosed to other companies. A copy of the research will provided for your perusal upon the successful completion of Miss Nattawadee's research, if requested.

Should you need further information, please feel free to contact me at telephone 300-4543 Ext. 1334 and I will be very willing to furnish any information about Miss Nattawadee's research.

Thanking you in anticipation of your positive cooperation.

Sincerely yours,

Tang Zhimin, Ph.D.

Director, Ph.D. Program Graduate School of Business  
Director Assumption Business Research Center

## **An Investigation into Cost-Benefit Analysis of Implementing ISO14000**

Dear Madam/Sir,

I am Miss Nattawadee Kositapa, student of MBA program of Assumption University. This research is part of my MBA program.

This questionnaire is one part of research study in “The costs and benefits of implementing ISO14000 standards”. All of the information will be used for academic purpose only. Your contribution in responding this questionnaire is highly appreciated. Thank you very much for your kindness and cooperation.

แบบสอบถามฉบับนี้ เป็นส่วนหนึ่งของการศึกษาเรื่องค่าใช้จ่ายและประโยชน์ของการปฏิบัติตามมาตรฐาน ISO 14001 ข้อมูลทั้งหมดจะใช้สำหรับการทำวิทยานิพนธ์เท่านั้น ขอขอบคุณมากสำหรับความกรุณาและความร่วมมืออย่างดีของคุณ

Miss Nattawadee Kositapa

### **QUESTIONNAIRE**

#### **Section 1 General Information**

(ส่วนที่ 1 ข้อมูลทั่วไปของบริษัท)

1. Name of your company :

(ชื่อบริษัท) :

2. Company address :

(ที่อยู่บริษัท) :

3. Telephone and fax number :

(หมายเลขโทรศัพท์และโทรสาร) :

4. Your organization position :

(ตำแหน่ง)



## Section 2 Costs and Benefits in EMS

(ส่วนที่ 2 ค่าใช้จ่ายและประโยชน์ของระบบการจัดการสิ่งแวดล้อม)

### **1. Costs (ค่าใช้จ่าย)**

The following are some basic costs for implementing EMS, please tick costs that your company incurred on the basis of your judgment : [(5) --- Extremely high costs, (4) --- High costs, (3) --- Appropriate costs, (2) --- Low costs, and (1) --- No cost ].

ค่าใช้จ่ายในการปฏิบัติตามระบบการจัดการสิ่งแวดล้อม โปรดใส่เครื่องหมายถูก ในช่องที่คุณคิดว่า เป็นค่าใช้จ่ายที่เกิดขึ้นในแต่ละข้อตามความคิดเห็นของคุณ: (5) ค่าใช้จ่ายสูงมาก (4) ค่าใช้จ่ายสูง (3) ค่าใช้จ่ายเหมาะสม (2) ค่าใช้จ่ายเล็กน้อย และ (1) ไม่เกิดค่าใช้จ่ายเลย]

### Supporting Activities

(1) (2) (3) (4) (5)

- **Management System** (ระบบการจัดการ)

1. Building up the system (designing concepts)

(การสร้างระบบ)

2. Development of an environmental management

handbook (documents)

(การพัฒนาเอกสารที่ใช้ในการจัดการสิ่งแวดล้อม)

3. Auditing the system

(การตรวจสอบระบบ)

4. Maintaining the system

(การบำรุงรักษาระบบ)

5. Certifying the system

(การรับรองระบบ)

- **Human Resource Management** (การจัดการทรัพยากรมนุษย์)

6. Training and education

(การฝึกฝนและการศึกษา)

7. Building up awareness

(การสร้างจิตสำนึก)

(1) (2) (3) (4) (5)

- **Technology Development** (การพัฒนาเทคโนโลยี)

8. Redesigning products

(การออกแบบผลิตภัณฑ์ใหม่)

9. Redesigning production process

(การออกแบบขั้นตอนการผลิตใหม่)

- **Procurement** (วิธีการใหม่)

10. Implementation of the new procurement

(ปรับปรุงและส่งเสริมวิธีการอื่นใหม่)

### **Primary Activities**

- **Operations** (การทำงาน)

11. Pollution abatement technology

(เทคโนโลยีในการลดมลพิษ)

12. Waste separation

(การแยกของเสีย)

- **Inbound Logistics** (การขนส่งภายในบริษัท)

13. Consumption of energy, water and other input materials

(การใช้พลังงาน)

14. Storage cost

(ค่าใช้จ่ายในการเก็บรักษา)

- **Outbound Logistics** (การขนส่งภายนอกบริษัท)

15. Distributing products to buyers

(การกระจายสินค้าสู่ผู้ซื้อ)

- **Marketing and Sales** (การตลาดและการขาย)

16. Communication costs

(ค่าใช้จ่ายการติดต่อสื่อสาร)



(1) (2) (3) (4) (5)

17. Labeling costs

(ค่าใช้จ่ายฉลากสินค้า)

● **Services**

18. Development and implementation of a repair

and upgrade services

(การบริการปรับปรุงและเพิ่มคุณค่า)

**2 Benefits (กำไรที่ได้รับ)**

The following are some possible general benefits of implementing EMS in a company, please choose them according to your judgment : [(5) --- Extremely high benefits, (4) --- High benefits, (3) --- Appropriate benefits, (2) --- Low benefits, and (1) --- No benefit ].

ประโยชน์ที่ได้รับจากการปฏิบัติตามระบบการจัดการสิ่งแวดล้อม โปรดใส่เครื่องหมายลงในช่องซึ่งคุณคิดว่าเป็นประโยชน์หรือกำไรที่คุณได้รับในแต่ละข้อ : [(5) มีกำไรสูงมาก (4) มีกำไรสูง (3) มีกำไรเหมาะสม (2) มีกำไรเล็กน้อย และ (1) ไม่เกิดผลกำไรเลย]

**Supporting Activities**

(1) (2) (3) (4) (5)

● **Management System (ระบบการจัดการ)**

1.Improved public image

(ภาพลักษณ์ของบริษัทดีขึ้น)

2. Better relations with public authorities, communities

and green activist groups

(มีความสัมพันธ์ดีขึ้นกับสาธารณะชน, องค์กร และกลุ่มพิทักษ์

สิ่งแวดล้อม)

3. Attracting shareholders/investors

(ดึงดูดนักลงทุน)

4. Better information on source of environmental

impact, early identification of problems

(มีแหล่งข้อมูลที่ดีทางด้านผลกระทบต่อสิ่งแวดล้อม,

รู้ปัญหาแต่เนิ่นๆ)

5. More efficiency and security due to environmental

management handbook

(มีประสิทธิภาพและความมั่นคงมากเนื่องจากมีคู่มือ

ด้านการจัดการสิ่งแวดล้อม)

(1) (2) (3) (4) (5)

- **Human Resource Management** (การจัดการทรัพยากรมนุษย์)

6. Increase awareness

(เพิ่มจิตสำนึก)

7. Higher staff commitment and better labor relations

(มีความร่วมมือและความสัมพันธ์ของแรงงานดีขึ้น)

- **Technology Development** (การพัฒนาเทคโนโลยี)

8. Renovation of product portfolio

(ปรับปรุงผลิตภัณฑ์ขึ้น)

9. Creativity and openness to new challenges

(สร้างสรรค์และเปิดกว้างกับการท้าทายใหม่)

- **Procurement (วิธีการใหม่)**

10. Better information on costs and potential savings

(มีข้อมูลที่ติด้านค่าใช้จ่ายและมีศักยภาพในการประหยัด)

### **Primary Activities**

- **Operations** (การทำงาน)

11. Reduced charges, pollution penalties, compensations payments

(ลดการจ่ายพิเศษ, บทลงโทษทางมลพิษ, ค่าชดเชย)

12. Lower waste costs

(ค่าใช้จ่ายเกี่ยวกับของเสียลดลง)

13. Productivity improvement

(เพิ่มผลผลิต)

- **Inbound Logistics** (การขนส่งภายในบริษัท)

14. Reduced consumption of energy, water and other input materials

(ลดการบริโภคพลังงาน, น้ำและวัตถุดิบอื่นๆ)

15. Less material input leads to lower storage costs

(ใช้วัตถุดิบน้อยลง นำไปสู่ค่าใช้จ่ายในการเก็บรักษาลดลง)



(1) (2) (3) (4) (5)

- **Outbound Logistics** (การขนส่งภายนอกบริษัท)

16. Reduced packaging costs

(ลดค่าใช้จ่ายบรรจุภัณฑ์)

17. Reduced transportation costs

(ลดค่าใช้จ่ายของการขนส่งของ)

- **Marketing and Sales** (การตลาดและการขาย)

18. Increased market share due to product innovation

(i.e., combined with an eco-labels)

(เพิ่มส่วนแบ่งทางการตลาดเนื่องจากคุณภาพสินค้าดีขึ้น)

19. Ensured access to foreign markets

(เพิ่มความมั่นใจว่าสามารถเข้าสู่ตลาดต่างประเทศได้)

20. Increased demand for traditional products and services which contribute to pollution abatement

(ความต้องการเพิ่มขึ้นสำหรับผลิตภัณฑ์ซึ่งลดมลพิษ)

- **Services** (การบริการ)

21. Repair and upgrade service open new markets

(ได้รับการปรับปรุงทางด้านการบริการให้ดีขึ้นเพื่อเปิดตลาดใหม่)



# APPENDIX

B





Cost Analysis

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CSMANAGE	43	2.60	4.00	3.3246	.4919
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CSHUMAN	43	1.50	3.00	2.4146	.4489
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CSTECH	43	3.00	4.00	3.6047	.4947
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CSPROCU	43	1.00	4.00	2.33558	1.2314
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CPOPER	43	2.50	4.50	3.5045	.8784
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CPINBO	43	2.00	5.00	3.0943	1.0554
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CPOUTB	43	2.00	4.00	3.0435	.7222
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CPMARK	43	1.00	3.00	2.7538	.4300
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CPSERV	43	1.00	4.00	3.3923	.7283
Valid N (listwise)	43				



Benefit Analysis

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BSMANAG	43	2.20	4.20	3.3428	.7759
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BSHUMAN	43	3.00	5.00	4.0349	.7104
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BSTECH	43	3.00	5.00	3.8837	.8226
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BSPROCU	43	2.50	4.00	3.2731	.4794
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BPOPER	43	1.67	4.00	3.5114	.4443
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BPINBO	43	2.50	4.00	3.2741	.5906
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BPOUTB	43	2.00	3.50	3.0541	.4526
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BPMARK	43	2.33	4.33	3.8942	.4744
Valid N (listwise)	43				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
BPSEV	43	2.00	5.00	3.6512	.7833
Valid N (listwise)	43				



