THE IMPLEMENTAION OF ENVIRONMENTAL MANAGEMENT SYSTEM IN KAMUNTING INDUSTRIAL ZONE: A BIO-ECONOMIC APPROACH

HUDA SAMEER MOHAMMED RASHAD ALMAAROFI

INSTITUTE OF BIOLOGICAL SCIENCE

FACULTY OF SCIENCE

UNIVERSITY Of MALAYA

2009

UNIVERSITI MALAYA

ORIGINAL LITERARY WORK DECLARATION

Name of Candidate: Huda Sameer Mohammed Rashad Almaarofi
I.C/Passport No: G1256691
Registration/Matric No: SGH 070003
Name of Degree: Master of Technology (Environmental Management)
Title of Dissertation/Thesis:
"THE IMPLEMENTAION OF ENVIRONMENTAL MANAGEMENT SYSTEM IN KAMUNTING INDUSTRIAL ZONE: A BIO-ECONOMIC APPROACH"

Field of Study:

I do solemnly and sincerely declare that:

(1) I am the sole author/writer of this Work;
(2) This Work is original;
(3) Any use of any work in which copyright exists was done by way of fair dealing and for permitted purposes and any excerpt or extract from, or reference to or reproduction of any copyright work has been disclosed expressly and sufficiently and the title of the Work and its authorship have been acknowledged in this Work;
(4) I do not have any actual knowledge nor do I ought reasonably to know that the making of this work constitutes an infringement of any copyright work;
(5) I hereby assign all and every rights in the copyright to this Work to the University of Malaya ("UM"), who henceforth shall be owner of the copyright in this Work and that any reproduction or use in any form or by any means whatsoever is prohibited without the written consent of UM having been first had and obtained;
(6) I am fully aware that if in the course of making this Work I have infringed any copyright whether intentionally or otherwise, I may be subject to legal action or any other action as may be determined by UM.

Candidate's Signature **Date**

Subscribed and solemnly declared before,

Witness's Signature **Date**

Name:

Designation:

ABSTRACT

Environmental Management Practices has become an important key factor in overall business planning and activities nowadays. Environmental Management System (EMS) is one of the environmental management practices which can assist organizations to meet their increasingly heavy onus of responsibility for better condition of future world's environment. Moreover, firms that adopted EMS have expertise in a wide range of benefits such as: cost saving benefits and a clear reduction in environmental/natural liability and calamity. Many studies have been carried out on investigating the benefits of the EMS, particularly for economy; however, none of these studies had shown any relation to a biological economics' model. In this study, Bio-Economic Models have been examined for 45 firms at Kamunting Industrial Zone/Malaysia. This study examined statistically the typical option of the environmental management aspect and showed the ability of EMS to decrease the cost of treatment effluent, decrease the capacity of treatment effluent, enhance the quality of water, and cost saving advantages in the area. The study indicated that 7% of the surveyed firms faced around 30%-40% cost benefit in their total operation cost in 2006. On the other hand, they were found to be more capable to reduce the capacity of the treatment pond, as well as improve the quality effluent. Arising from these findings, a true consideration should be given to maximize the adoption of the EMS and other environmental friendly practices, and minimize the consumption of natural resources in order to earn a healthy and better green world, both at present and in the future.

ABSTRAK

Pengurusan dan pertimbangan alam sekitar telah menjadi sebahagian penting dalam keseluruhan aktiviti dan perancangan perniagaan pada masa kini. Peningkatan pengetahuan dan kesedaran mengenai alam sekitar telah mendorong banyak syarikat dan organisasi untuk mengadaptasi alat bantu untuk prestasi persekitaran yang lebih baik. Sistem Pengurusan Alam Sekitar (EMS) merupakan salah satu perundangan alam sekitar yang semakin meningkat penggunaannya dalam aspek persekitaran bagi membantu sesebuah organisasi untuk memenuhi tanggungjawab terhadap alam sekitar pada masa akan datang. Secara amnya, pengenalan kepada Pengurusan Alam Sekitar (EMS) mampu menjimatkan kos dan mengurangkan beban dan bencana alam sekitar/semulajadi. Banyak faedah yang diperolehi oleh firma yang mengadaptasi EMS. Banyak kajian mengenai kebaikan EMS terutama dari aspek ekonomi telah dilaksanakan. Walaubagaimanapun, tiada kajian mengenai model ekonomi khusus yang dijalankan. Dalam kajian ini, model bio-ekonomi telah diselidiki. Secara statistik, model ini telah menunjukkan kemampuan EMS untuk mengurangkan kos rawatan kumbahan, mengurangkan amaun rawatan kumbahan, meningkatkan kualiti air, dan faedah penjimatan kos. Pada masa yang sama, kajian ini juga melibatkan perspektif dalaman, yang merupakan opsyen khas aspek pengurusan alam sekitar di Zon Industri Kemunting untuk 45 firma pengurusan. Kajian telah menunjukkan bahawa 7% daripada firma yang diselidiki mampu menjimatkan kos sekitar 30-40% daripada keseluruhan kos operasi. Pada masa yang sama, mereka juga mampu mengurangkan amaun kolam kumbahan seterusnya meningkatkan kualiti kumbahan. Hasil daripada kajian yang dijalankan, pertimbangan yang sewajarnya perlu

diberikan dalam memaksimumkan penggunaan EMS dan lain-lain pengamalan mesra alam sekitar, dan mengurangkan penggunaan sumber alam sekitar bagi memastikan kehidupan yang lebih sihat dan dunia hijau pada masa kini dan akan datang.

Acknowledgements

What a wonderful experience, even though it is full of pain, tears, and stress but what I have gained is not measurable. I will forever be thankful to Allah, for giving me this opportunity and helping me throughout this journey. I would like to express my deepest gratitude to my supervisor, Dr. Noor Zalina Mahmood, for her generosity, encouragement and support, and who has given me the guidance and motivation to turn this paper into reality.

I also would like to acknowledge the help given at Kamunting Industrial Zone, all the survey firms rendered a good cooperation in responding to all the survey questions and sparing their time and offering their assistance; without them this research paper would not been possible.

I sincerely thank Mr. Boura Alali, Mr. Richard Porter, Mr. Omar Ismail Awad, Mr. Hilal Alshikaly, and Mrs. Poopak Satodilheia, who have encouraged, helped, supported, and prayed for me. A special thank goes to all my friends, both in Malaysia and Iraq, who have made me laugh and made my journey much easier.

No thanks can adequately express my appreciation to my lovely family, my mom, dad, my brilliant elder sister and my brother in law Dr. Ali Douabul; I love them very much. Without them, I can never reach this stage. They have always been supporting and I pray that GOD will always grant them good health, peace, and happiness, for being the candles of prosperity.

Huda Sameer Mohammed Rashad

Department of Biological Science

Faculty of Science

University Malaya

Table of Content

List of Figures

List of Tables

Abbreviations

EMS	Environmental Management System
ISO	International Organization for Standardization
BS	British Standard
EMAS	Eco Management and Audit Scheme
IE	Industrial Ecology
USEPA	United State Environmental Protection agency
SPSS	Statistical package for Social Science
ECM	Environmental Consideration and Management
QMS	Quality Management System
PP	Pollution Prevention
SD	Sustainable development
EMA	Economical Model Aspects
EA	Environmental Auditing
EPE	Environmental Performance Evaluation
ELDS	Environmental Labels and Declarations Standards
LCA	Life cycle Assessment
EAPS	Environmental Aspects in Products Standard
BM	Bio-Economic Model
MITI	Ministry of International Trade and Industry
IIU	International Islamic University
MC	Management Commitment
OC	Organization Control

EIC	External and internal Communication
TA	Technical Approach
KIZ	Kamunting Industrial Zone
MDOE	Malaysian Department of Environment
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
TSS	Total Suspended Solid
O&G	Oil and Grease
CPT	Cleaner Production technology
EOP	End-of-Pipe technology
ETP	Effluent Treatment Plant

CHAPTER 1

INTRODUCTION

1 Introduction

Environmental Management Practices (EMP) has become one of the most important parts of the overall business planning and activities nowadays. The negative impact of different industrial activities expands the environmental knowledge and awareness in most companies and organizations to adapt voluntary tools for better environmental performance like Environmental Management System (EMS) and International Organization for Standardization (ISO). These tools help different companies especially, the industrial sector, to move beyond environmental complains. However, these standardizations enhance the companies' image, and gain economic advantages.

1.1 Environmental Consideration and Management Tools

1.1.1 Environmental Management System (EMS)

1.1.1.1 EMS definition and importance

The EMS introduced to the world as a group of several management processes and procedures that control companies' or/and organizations' activities like production and services, as well as reduce their operational impacts on the environment (United State Environmental Protection Agency (EPA)).

EPA also mention that EMS is an easy program to implement, as it doesn't intend to impose overall new technical requirement or to work as bases for the existing

regulatory requirement but it's a systematic method to all types of private sectors as well as public agencies help them manage their environmental aspects, policy and targets to improve their financial and environmental performance.

Since the early use of EMS, different definitions have been used according the applied countries, the most practical definitions indicate that EMS is:

- A formal set of procedures and policies controls the potential activities of organizations and designate the negative impact of these activities on the nature of the environment and its health. On the other hand, the policies protect the welfare and workers, who are in contact with these harmful activities, from getting heart. The procedures and policies are also assess, catalogue and quantify environmental impacts throughout the entire organizations (Darnall *et al*., 2000).

- A tool use in problems identification and problems solving. It provides organizations with a method to systematically manage their environmental activities, products and services. It also helps organizations to achieve their environmental obligations and performance goals (Europa website on EMAS).

- A continual cycle of planning, implementing, reviewing, improving the processes and actions that organizations undertake to meet their business and environmental goals (USEPA website).

The EMS becomes very important to the society. It expands the need for environmental protection issues; it also helps organizations to regulate the demands

placed on it in a systematic and cost-effective manner. Furthermore, the implementation of EMS can also help to reduce the effects of non-compliance and improve employees' health and safety practices as well as the public's. In addition, the EMS can help to organize certain non-regulated issues such as energy conservation, and strengthen the operational control system and the relationship between the officers and the staff.

1.1.1.2 EMS Implementation successes

The success of EMS reverts to the five important principles:

a) Commitment and policy
b) Planning
c) Implementation
d) Measurement and evaluation
e) Review and improvement

These principles are basically derived from the Deming Model of Quality Management (Figure 1).

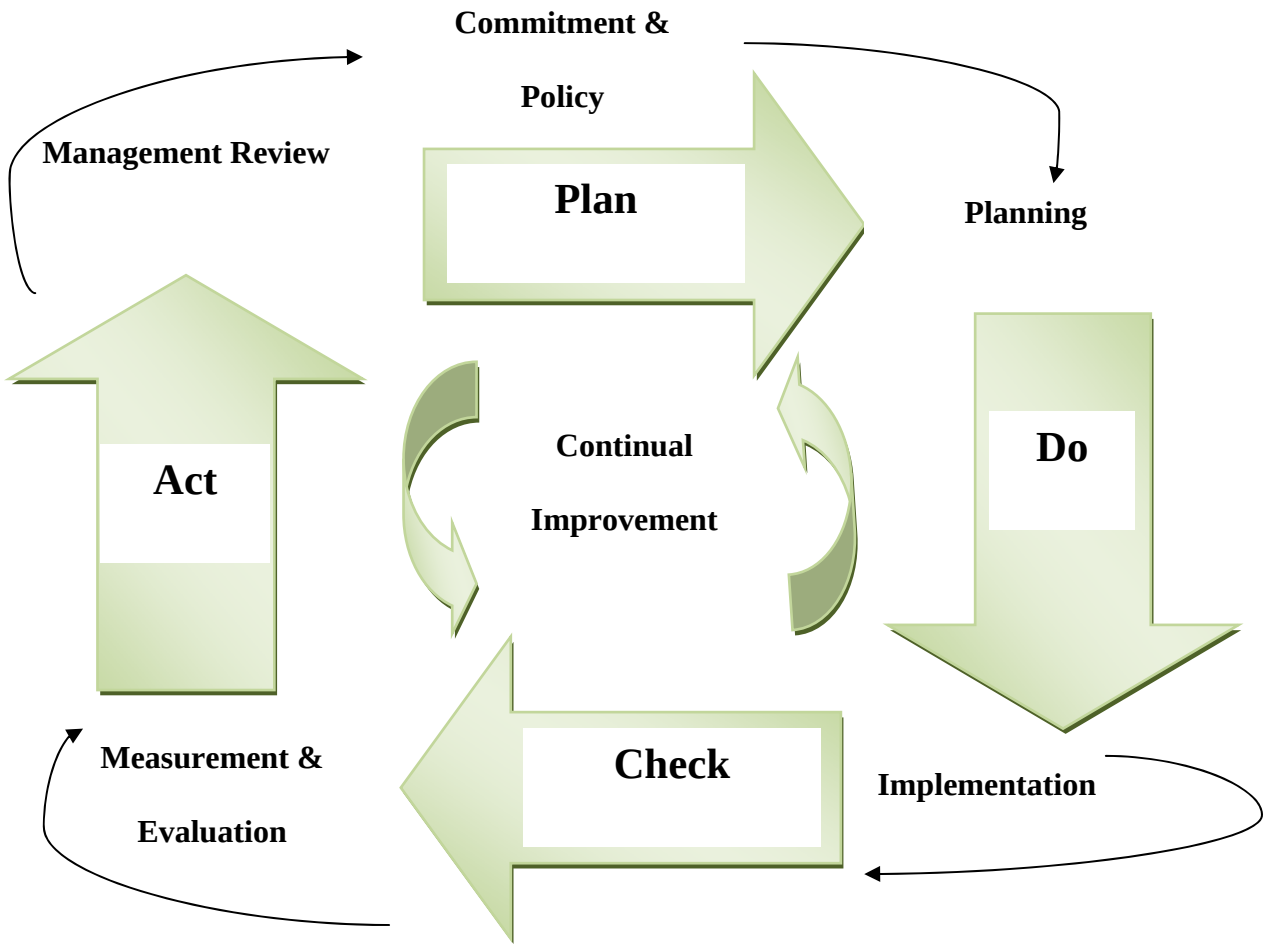

Figure 1: The Deming Cycle Management Model, modified from Arveson, 1998.

The success factors of the EMS implementation could vary from one country to another and these include governmental legislation, economic and political, as well as cultural factors (Global Environment & Technology Foundation, 2006).

1.1.1.3 EMS development

Since 1970s, many businesses have developed their own EMS in term of sustainable development and environmental aspects to become more significant and beneficial. The modified EMSs help minimize the negative impact of many organizations on the environment and increase their economic performance, which tern the attention toward the environmental management practices researches.

Different studies have been done in order to find the best and most efficient EMS to control the negative impact on the environment. Hui *et al*. (2001) mentioned in their study that each country's legislation, rules and regulations, which have bad environment issues, should encourage the productive sectors and organizations to implement the EMS. The main endeavour of these systems is to protect the environment by creating a connection between the economy and the environment. In addition, Culley (1998) and Steger (2000) indicate that the EMS is a regular process given to the industrialized businesses to depict and implement their environmental goals, legislations, and liabilities, as well as re-arrange their auditing elements. On the other hand, Epstain *et al*. (1997) and Stock *et al*. (1997) in their studies also indicate that the EMS is a long-term voluntary standard, which can help firms to improve their processes control, production, and services, as well as it helps to save cost and enhance profits.

According to Miles *et al*. (1999), Small and Medium Enterprises (SMEs) have particular difficulties in implementing the EMS; these difficulties are associated either with financial and/or hand work limitations. In relation to this, Hillary (2004) explains that the level of environmental impacts of the SMEs is not detectable at the national or regional levels, but the SMEs may often contribute to about 70% of industrial pollution. Seiffert (2008) refer to the importance of the financial and human resource limitations in the success of the EMS. On the other hand, the maintenance of the EMS is connected to the planning stage, particularly in relation to the sub-system (requisite) of environmental aspects and impacts, which are mainly related to the complexity of the adopted methodologies.

Many methods have been established to be used with the implementation of the EMS in enhancing environmental protection and source conservation in a frame of economic Models, International Organization for Standardization (ISO) 14001, and Strategic Sustainable Development (SSD). In this term, Garner *et al*. (1995) in their study define the industrial ecology as a new framework which serves to identify and thus implement strategies to reduce the negative impacts of products and processes associated with industrial systems on the environmental with an ultimate goal of sustainable development. In addition, Korhonen (2004) indicate that the Industrial Ecology can work side by side with the Strategic Sustainable Development systems to achieve the maximum protection for the environmental, especially in multi-national organizations. Douglas (2000) agreed with Garner *et al*. (1995) that integrating Bio-Economic model is an economic optimization in its pure sense which refers to the systematic evaluation of number of alternative activities to determine the one which will result in the “best” or optimum performance.

The implementation of the EMS can result in non-value added costs if it is adopted only for marketing or regulatory appeal; however, the true value can be realized only when the EMS is consistently implemented within the company's strategic direction. Many researchers are found refer to the environmental regulation and its relationship with the environmental innovation and performance of firms. On the other hand, very little serious empirical work has been done, specifically on the economic advantages of EMS. Furthermore, no evidence on the extent of the penetration of the advanced EMS practices with Bio-Economic side of view.

1.1.2 International Organization for Standardization (ISO) 14000 Series

1.1.2.1 ISO definition and importance

The ISO is a non government organization established in Geneva, Switzerland in 1947, which provides environmental standardized procedures in order to sets a series of standardizations which concern with environmental benefits that often become law.

The family of ISO 14000 series of standard or guidelines can be classified in to two discrete categories (Figure 2):

a) Organization Evaluation:

- Environmental management system (EMS) standards, ISO 14001 and ISO 14004, which became the primary concerns in the current study.
- Environmental Auditing (EA) standards - ISO 1410, ISO 14011 and ISO 14012.
- Environmental Performance Evaluation (EPE) - ISO 14031.

b) Product Evaluation:

- Environmental Labels and Declarations Standards (ELDS) - ISO 14020, ISO 14021, ISO 14022, ISO 14023, and ISO 14024.
- Life Cycle Assessment standards (LCA) - ISO 14040, ISO 14041, ISO 14042 and ISO 1404.
- Environmental Aspects in products standards (EAPS) - ISO 14060.

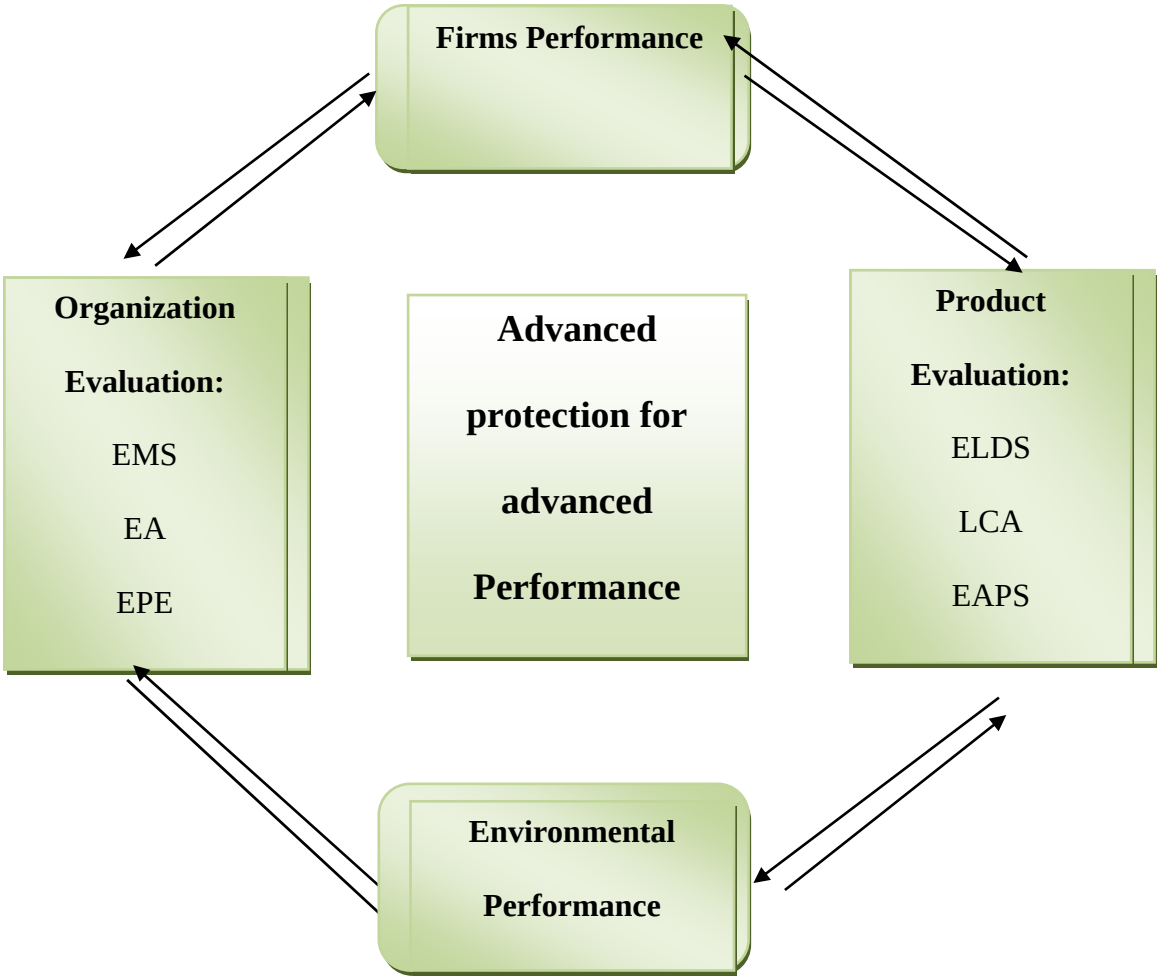

Figure 2: The ISO 14000 Series Standards, 2007, modified from Baxter, 2007.

ISO 14001:2004 sets of standards provide the requirements for an EMS and its implementation; thus, fulfilling the need to demonstrate that the EMS is operating effectively and within the standard. In addition to ISO 14001, ISO 14004:2004 provides a general guideline to prove and implement the EMS principles. Meanwhile, ISO 9000 concerns with the practices for a better organizational Quality Management System, which include financial and economic aspects.

1.1.2.2 Development of ISO series

The ISO 14001 standard is one of the standards of ISO 14000 series, which identify the requirements of the EMS. These standards are not intended to set environmental performance goals, nevertheless they specify the elements of a management system which provides a framework for organizations development and maintain a reliable process that consistently meets environmental obligations and commitments (Woodside *et al*., 1998). As it mentioned before, the EMS not only provide a framework to help create a better environmental management system and improve its performance, it also require periodic self-assessment or internal audit to be carried out. This statement has been clearly stated in the United Nation Conference of Environment and Development (UNCE) at Rio de Janeiro in 1992. In the ISO 14001:2004 guidelines, new legislations have been improved since the UNCE in 1992 and focused on establish and maintain a better programs and procedures to obtain periodic EMS audits. This can be achieving by providing decent information data base as well as determine whether the programs have been properly implemented and maintained.

All of the standards and guidelines under the ISO 14000 series serve as guidance, except for ISO 14001, i.e. the only standard intended for registration by the third parties. At the following points are the main unique characteristics of ISO 14001(Transforming Strategies website):

1. It is comprehensive. All members in the organizations participate in environmental protection methods; the EMS considers all stakeholders and the process to identify all the negative impact on the environment.
2. It is proactive. It focuses on the forward thinking and acts instead of reacts to commands and control policies.
3. It is approachable system. It stresses on improving the environmental protection by using single EMS across all functions of the organizations.

1.3 Industrial Ecology (IE)

Industrial Ecology (IE) is, in part, a technological method, in which applied in manufacturing, include industrial processes design, products, and services, seeking product competitions and environmental concerns values. It is also a sociological method, in regards human culture, individual choice, and social institutions that play major roles in defining the interactions between technological society and the environment. Lifset and Graedel (2002) identify the IE in which "*the means by which humanity can deliberately and rationally approach and maintain sustainability, given continued economic, cultural, and technological evolution. The concept requires that an industrial system be viewed not in isolation from its surrounding systems, but in concert with them. It is a systems view in which one seeks to optimize the total materials cycle from virgin material, to finished material, to component, to*

product, to obsolete product, and to ultimate disposal. Factors to be optimized include resources, energy, and capital."

Since the Industrial Revolution, men start to realize the negative impact of the industrial activities on the environment, especially when these businesses failed to process their firms according to the environmental safety. For example, some industries have been less respected to their long term detrimental impact and its consequences. Figure 3 shows some examples of these interactions that indicate the difficulties created for the society by industries (Figure 3).

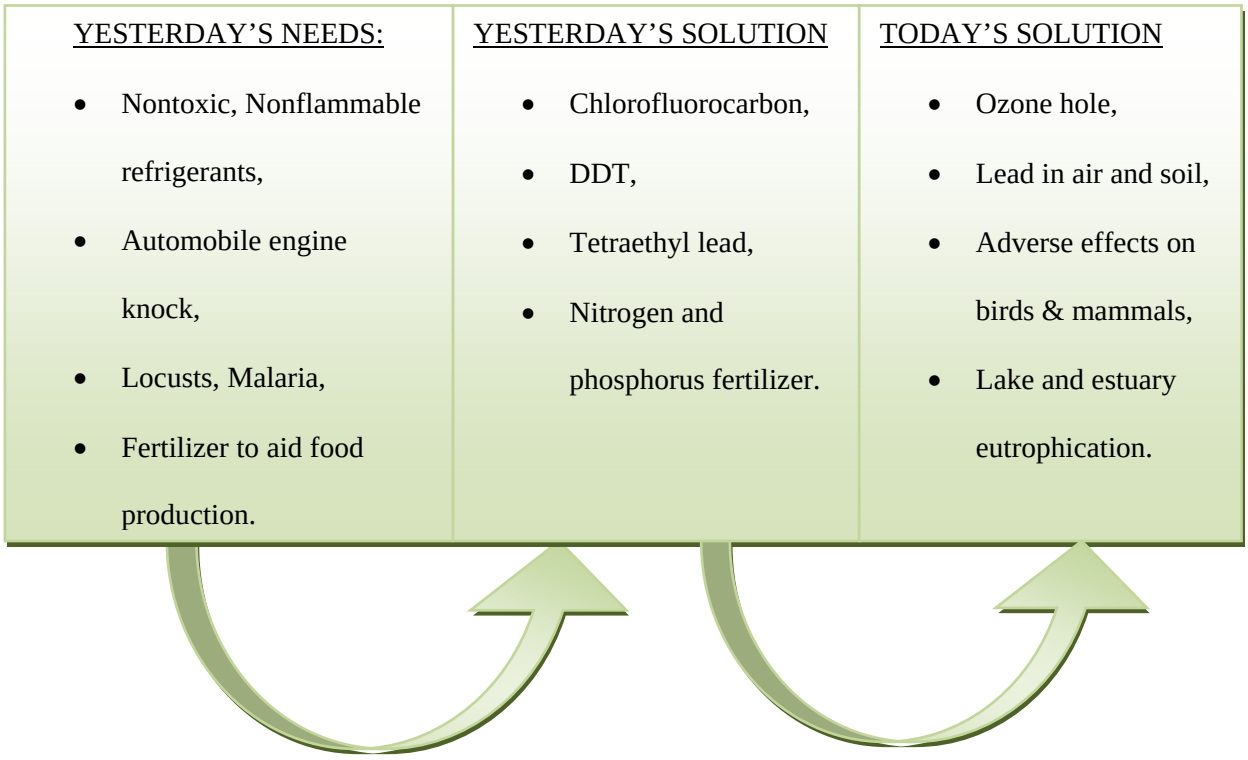

Figure 3: Relating Current Environmental Problems to Industrial responses of Yesterday Needs, modified from Lifset & Graedel, 2002.

Industrial pollution, on a limited scale, associated with the industrial sector. In most cases, industrial pollution could extend to the exterior environment and it affects even reach the surrounding habitat. The contrast between traditional environmental approaches of industrial activity and those suggested by industrial ecology can be demonstrated by considering several time scales and types of activities (Table 1).

Table 1: Future aspects for industrial environmental strategy.

Pollution Control Activity	Time	Focus	Main Point	Action
Remediation	Past	Local site	Human safety	Superficial
Treatment, disposal	Present	Local site	Human safety	Superficial
Industrial Ecology	Future	Global	Sustainability	Strategic

So far, industrial ecology deals with practices that look to the future, and seek to guide industries to choose effective operation methods, which can be more beneficial to the environment and optimize the entire manufacturing process for the general good.

1.4 Environmental Sustainability (ES)

The major problems and pollutions associated with the industrial technology and its activities for long term until now changed most of the factories owners and manufacturers to appreciate the right of the Mother Nature. As a result, the environmental credibility has become a target factor to start from in the national and international competitiveness (Curkovic *et al*., 2005). Hence, the implementation of ISO 14001 and the subsequent registration can facilitate progress through measurement and innovation leading to increased profits, more efficient processes,

reduced costs and more credible image. According to Sambasivan *et al*. (2008), many countries have already declared ISO 14001, for example, to be their own national standard. In addition, Yahya and Goh (2001) claimed that obtaining an ISO 14001 certification was considered as a ticket to enter the global market. According to the statistics published by ISO in 2003, at least 49,462 ISO 14001 certificates were issued in 118 countries. Japan, with a plan from the government to subsidize some of the costs for its small and medium enterprises (SME), leads the pack. On the other hand, many organizations have decided to delay the certification because of the difficulties in determining the tangible and intangible benefits or impacts considering the cost incurred (Babakri *et al.,* 2003). In this term, Babakri *et al.* (2003) argue that organizations need to look at both the economic and institutional factors which influence them in implementing the EMS.

1.5 Environmental Technologies

In order to achieve a healthy environment, many types of environmental legislation and regulation had appeared. The traditional means of combating pollution was End-of-Pipe technology (EOP). EOP systems involve treating water, air, noise and solid wastes. A whole range of technologies are Participated from the biological and chemical systems used for treating water such as filtration systems, and other barrier systems used for air filtration beside simple ways for waste recycling and various composting or disposal methods. For any stream, there will probably be a series of equally acceptable treatment options with different quality for economics and environmental performance (UNEP Annual Report 2005).

With the development taking place in the world today has become necessary to find ways and new techniques for the treatment of pollutants so as to be more accurate and effective than its predecessor. That's when Cleaner Production Technology (CP) first introduced as continual effort to prevent pollution; reduce the use of energy, water and material resources; and minimize waste in the production process. It involves rethinking products, product components and production processes to achieve sustainable production and our natural environment. By reducing our demand on non-renewable resources, and recycling and re-using products and resources, we can reduce our impact on the natural environment (Bradshaw, 2008).

Many businesses do not realize how much money they lose in wasted materials, energy and water, or through handling, storing and disposing of waste materials. Large and small businesses can save money by introducing cleaner production.

1.6 Bio-Economic Approach:

For the past century, environmental policies have been influenced by the economic efficiency and biological processes that equity developed increasingly from models. Moreover, these models have grown in size and complexity, enabled by the rapid developments in environmental science issues and gain an interesting attention, especially when the bioeconomic models become in use. Generally, *Bioeconomics* is the study of the dynamics of living resources using economic models. It is an attempt to bridge the empirical culture of biology and the theoretical culture of economics, through methodology like environmental economics and ecological economics. Bioeconomics uses different mathematical modeling and optimal control theory as they relate to economics; it also uses environmental and ecological elements for

resource protection issues relating to resource economics. Bioeconomics may be referred to the study of the possibility of all kinds of organisms to earn their living in "nature's economy," with particular emphasis on co-operative interactions and the progressive elaboration of the division of labor (Reinheimer, 1913). It can be considered as a tool for policy analysis to enhance the understanding of development and to assess the impact of alternative policies on the natural resource base on human welfare (Holden *et al.,* 2004). One of the potential benefits of this model is that one can get a better and more comprehensive indication of the feedback effects between human activity and natural resources.

1.6.1 The use of term Bio-Economic

Corning (1996) shows in his study that there are different pathways for using the term ‘bioeconomic’. The earlier way was explained by Georgescu-Roegen's thermodynamic analyses that work in ecological economics on the problems of fisheries management. After that different alternatives were introduced, for example, a bioeconomic paradigm used with Reinheimer's original conceptualization of bioeconomics as a science that is focused on the fundamental problem shared by all living species, namely survival and reproduction (Corning, 1996). Corning (1996) mentioned that the term "adaptation" is the main concept in a modernized bioeconomic paradigm sensu Reinheimer. He indicates also that adaptation refers to the strategies and tactics that an organism consumes to meet its/their basic biological "needs." The adaptation phenomenon faced a wide acceptation and it becomes extensively studied in the life sciences, ethnology, and sociobiology (Corning, 1996). On the other hand, adaptation studies were also heavily studied, especially within the

behavioral ecology and socio-ecology (Corning, 1996). The prohibiting of the concept of adaptation from mainstream economics may appear anachronistic, excluding for the fact that it challenges some of the most fundamental hypothesis and axioms of the dismal science (Corning, 1996). Bioeconomic can closely relate to the early development of theories in fisheries economics, initially their idea used recent achievements in biological fisheries modeling which mash a formal relationship between fishing activities and biological growth through mathematical modeling, and relates itself to ecology and the environment and resource protection.

1.7 The Organization of the Study

This study attempted to show whether or not the implementation of EMS resulted in economic benefits, analyze the associated impacts and their inter-relationships with the legal and other requirements which are fundamental for the planning phase of an EMS, and develop a successful implementation process.

Chapter 1 introduced the Environmental Management Practices tools (EMS and ISO) in detail. It also explained the importance and applications of these tools. A comprehensive literatures review was introduced and discussed the different implementation of EMS that have been used and its development. The basic theories and model of industrial ecology listed as well as the bio–economic approaches were discussed. In chapter 2, the development of different economic approaches in different countries will be discussed. Chapter 3 will include an exclusive summary of the planning methodology used in the current study. The analysis and results will be presented in Chapter 4, whereas a general discussion based on the results of the study

will be presented in Chapter 5. Finally, Chapter 6 will provide conclusion and recommendations for future work.

1.8 Objectives of the Study

The general purposes of this study are to evaluate and analyze the principles of the environmental management system, among 45 firms which are involved in different kinds of industrial activities such as textile/clothing, workshop, food/restaurant, food-based products, hand gloves, chemical, clinical waste treatment, palm oil refineries, landfill, hotels, electronic, etc., located in Kamunting Industrial Zone, Malaysia. According to the wide interest of this study the main objectives will intend to achieve the following:

1. Identify the types of environmental control and management strategies among industries.
2. Compare management techniques/strategies used by different firms to prevent pollution.
3. Identify the cost-benefits measure.
4. Identify and analyze barriers for implementing EMS.
5. Identify the typical option to improve resource conservation and management.

Hence, it was within the scope of the research to investigate the influence of the implementation of EMS on the performance of various firms, including the economic

and environmental aspects, as well as to study firm's behavior towered in environmental conservation issues.

1.9 Significance of the Study

The implementation of the EMS has been proven to benefit us in various ways among other, it has enabled us to:

1. Improve the ability to meet the compliance requirements;
2. Increase efficiency, reduce costs and greater operational consistency;
3. Improve environmental awareness, involvement and competency throughout the organization;
4. Create a better communication in relation to environmental issues inside and outside an organization; and
5. Achieve better relationships with regulators.

1.10 Limitations of the study:

In this study, several restrictions and difficulties were mainly related to the methodology that has been used during the project. The most difficult issue associated with the overflow of information which is available for the existing research subject. Therefore, the identification for the specific researches was too difficult. On the other hand, the financial support interferes with the ability to collect information from the internet. There were also a lake of information and knowledge of Asia and Malaysia's context. Therefore, the most available information was

gained from overseas countries, like United Kingdom, United State, Canada, and Australia.

The obstacles faced though this study process are represented by the difficulties of collection the information from some of the firms because of the several surveyed firms have not a specific environmental section in their place regard to their limited place since the majority of the surveyed firms are of small and medium size enterprises. However, the author had redressed this problem by getting an interview with a specific environmental person of the firm, and tries to get all the information needs for the research directly through answering the questionnaire sheet. Adequate data have been collected from journals, articles, conference papers, and environmental organizations' publications such as EPA, SIRIM, and Euorpia as supporting information to mitigate the author's lake of this subject competency.

There was also a time gap in the literature, which carried out to identify the unique success factors and benefits as a result of the EMS implementation as well as the determination of the causes of developing factors. Although this study was done in Malaysia, the researchers believed that the approach and the framework discussed in this paper could easily be applied to other countries, either with no or a slight modification.

CHAPTER 2

THE LITERATURE REVIEW

2 Overview and Rotation

The environment has a direct effect on the ecosystem. It is no longer just the air we breathe, or the world we live in, but it has become important for businesses to address the environment in order to maintain customers, and exist “prosper” in an ever more critical global economy. Perhaps, waste of resources and creation of pollution are normally indications of areas for significant improvement. All of the environmental standards address the need for a continuous and never ending improvement in striving to protect our environment, not only for ourselves, but also for future generations to come.

So far, there is an ascending spiral of the new environmentally related legislation. Environmental management practices can assist an organization to meet its increasingly heavy onus of responsibility for the sake of the future conditions of our world environment. In addition, environmental management practices can also aid in cost savings, and reducing environmental liability, which will be discussed in the subsequent section. However, through increasing the productive technologies which the world has faced since the past century, natural environment and our ecosystem have been greatly affected. As a result, conservation is what we need to address these days. In particular, there are a number of standards available, around which EMS can be modeled.

This chapter will provide an overview of the EMS and its related practices and issues such as ISO14001 and industrial ecology which provide not only a specification but also more advice on a wide range of environmental issues, including auditing, labeling, life-cycle assessment, etc.

2.1 Nature and Environmental Management

To go through EMS, first we need to know the various components of the nature resources, as well as the prospective issues in managing the affected environment. Natural resources are all the substances which appear naturally without the help of man and have a valuable consideration in their comparative natural form. In fact, the value of natural resources is leaning about the amount of the material available and its demand. There are two types of natural resources; renewable resources (i.e. can be replenished by means of natural processes such as solar radiation, winds, hydroelectricity, fresh water, timber, etc.) and non-renewable (i.e. cannot be re-made, re-grown or regenerated on a scale comparative to its consumption, such as fossil fuel and nuclear power). On the other hand, the components of natural resources include both ecological and physical components. The ecological component is the function of units as a natural system (without human invention), including all vegetation, animals, micro-organisms, rocks, atmosphere and natural phenomena which occur within their boundaries, while the physical component of the natural resources illustrates the universal nature of the natural resources which cannot be limited within boundaries such as air, water, and climate, as well as energy, radiation, electric charge, and magnetism, which are not originating from human activity. Natural resources are exposed to the dangers of continuous depletion and destruction

from various productive sectors. Therefore, the concept of environmental management is introduced in different aspects all over the world in order to maintain and conserve natural resources. It is well known that the environmental management illustrates is a systematic approach established to find practical ways to save both renewable and non-renewable types of natural materials. It is also use to reduce the negative impacts on the environment. In additional, the environmental management can help saving money, getting recognized for environmental leadership, and preserving as well as protecting unique destinations.

According to MacNeill (1971), Petak (1981), and Garlauskas (1995), environmental management can be defined as a “multilayer process associated with the interaction of state or non-state environmental managers with the environment. Environmental managers are those people who possess the power of action to manipulate the environment through the aim of enhancing predictability of the rapid development with a context of social and environmental performance.” Environmental management practices have a significant function to help reduce costs in operation and improve organization's profitability. According to Cairncross (1992) and Hart (1995), the substantial nature of environmental management Practices is to help firms toward improving their competitive positions, at the same time, reduce the negative effects of their activities on the natural environment by implementing certain "best practices" of environmental management. This also includes a cost advantage benefit which can result from adopting the "best practices" which focus on firms' production processes (Hart, 1995; Stead and Stead, 1995). Such “best practices” include redesigning production processes to be less polluting, substituting less polluting inputs, recycling by-products of the process, and innovating less polluting processes

(Ashford, 1993; Hart, 1995). Environmental management practices could enhance the particular organization's images in the global market and other environmental corporations. And also the environmental protection activities have become an inseparable part of business operations and thus, they may improve organizational reputation (Welford, 1995). The relationship of environmental management with operational activities of firms impresses the development of the organizational functions such as marketing, operations, finance, personnel, supply, and management information systems (e.g. processing of new information).

The existing literature addressed a number of benefits of the environmental management issues in corporate firms (Porter, 1995), which include (1) cost savings and improvements in firms' efficiency, (2) product quality improvements, (3) increase in market shares, (4) getting ahead of competitors and legislation, (5) access to new markets, (6) enhance employee motivation and satisfaction, (7) improvements in public relations, and (8) access to financial aid.

2.2 Environmental Management System Standards (EMSD)

There are a number of EMSD adopted by interested organizations in order to manage their activities to reduce related environmental risks. Among these EMSD is the British standard BS7750 that published in 1993. This standard has reviewed and revised in January 1994 and subsequently withdrawn in September 1997. The world's first standard for Environmental Management System, BS 7750 developed by the British Standard Institution. However, the Eco-Management and Audit Scheme (EMAS) was developed and first published in 1993 by the European omission for countries of European Union. Similarly, ISO 14001 become one of the

guideline under the ISO 14000 series. This guideline established to ensure that it is applicable to all types and sizes of organizations and to accommodate diverse geographical, social and cultural conditions. All these standards have similarity as the latter two were developed based on the British Standard BS 7750. However, the European-Wide standard or EMAS has gone beyond in a number of ways as compared to ISO 14001 (Figure 4).

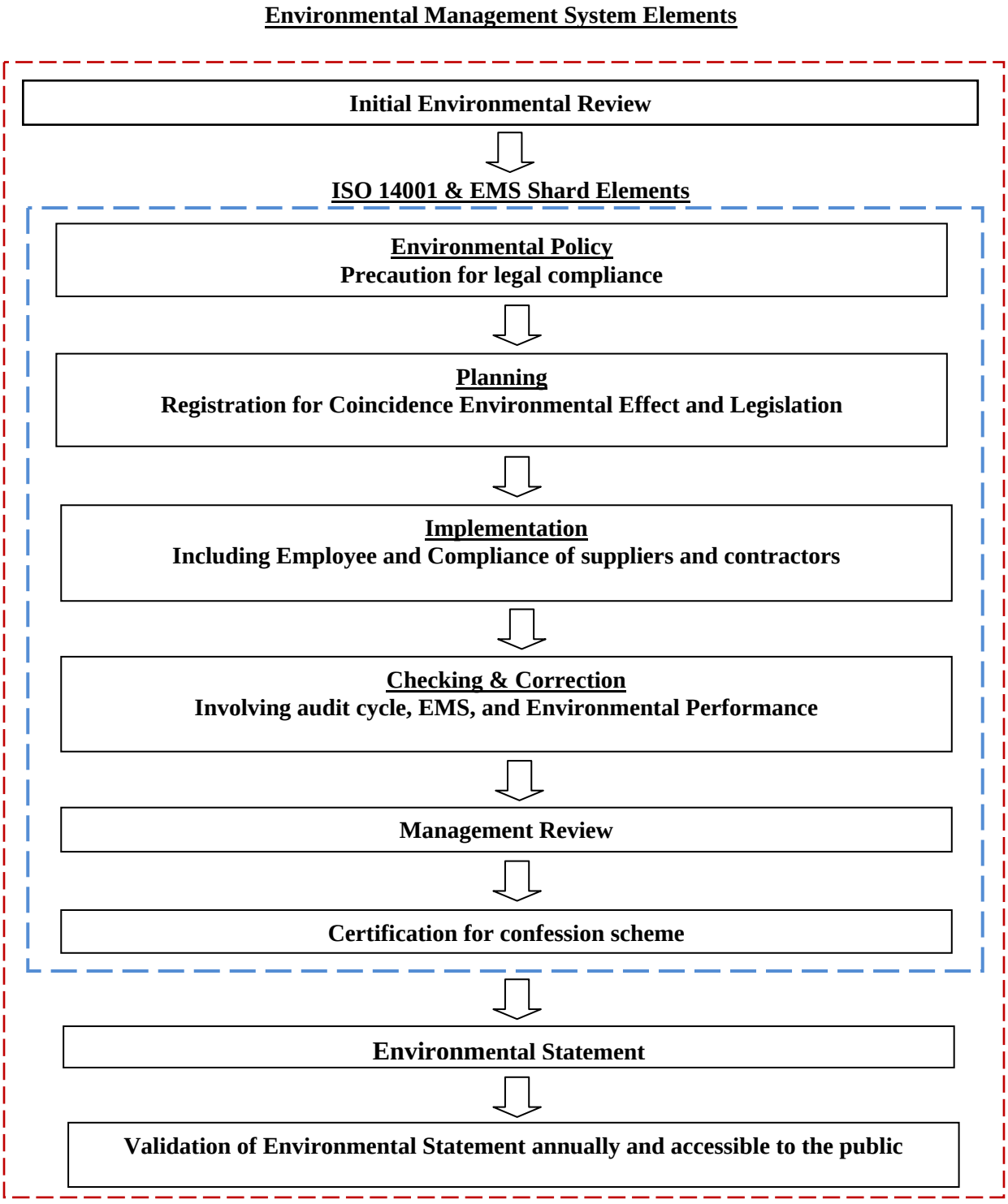

Figure 4: The EMS implementation – EMAS and ISO 14001 Elements, adapted from Europa, 2005.

Rennings *et al*. (2006), shows in his study that there are no significant influence for the characteristics of environmental management system to the surveyed companies. On the contrary, Mari and Seiffert (2008) revealed that getting certified of ISO 14001 EMS could help industrial sector to present their product in the "Global Market," particularly when the Environmental Impact Evaluation (EIE) system had become a part of the EMS. From another perspective, Clark *et al.* (2003) study revealed that economic, energy, and environmental aspects are going on the same path, in which any augment of a specific action, towered both process and product benefits in any business. This is referred to the fact that clarifies the new "environmental sound friendly" technology can help in minimizing emissions conduct a commercial value.

The impacts and benefits of the EMSs are fundamental, rather than being conditioned by the general strategic orientations which lead to the implementation of one of the systems (Rennings *et al*., 2006). During the initial introduction of the ISO 14001, the data gathered in 1998 showed that 52.4% of the total 7,887 ISO 14001 certified facilities were located in Western Europe and 37% in Asia. On the other hand, American certified companies are only accounted for 3.7% of the total certified facilities of the world in 1998 (Delmas, 2002). The small number of the American companies' adopted ISO 14001 could be linked to the institutional set up of the United States of America which might impede the diffusion of ISO 14001 within the country. This has been supported with survey data collected from the studies conducted on a re-presentable sample of certified facilities in the United States (Delmas, 2002).

The numbers of ISO 14001 certified organizations have tremendously increased in the last century. The statistical data, collected by Demas *et al.* (2004), showed that

the total number of ISO 14001 certifications or registrations in the world now is 46,836. It is also indicate that Japan has the highest number of ISO 14001 certifications, followed by Germany and Spain. Malaysia ranked in the third place, within the South East Asia region, with a total number of 374 certifications (Figure 5).

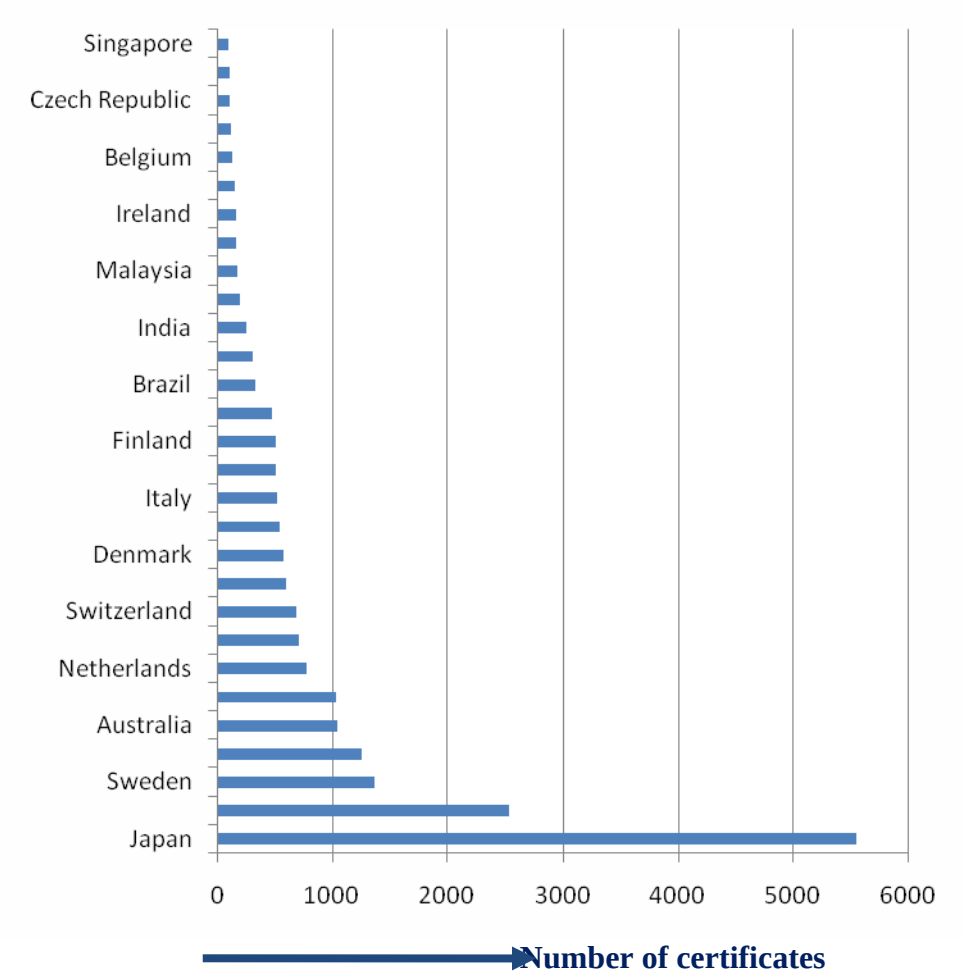

Figure 5: The number of ISO 14001 certifications in some countries around world, adapted from Delmas *et al.*, 2004.

The huge number of certifications organizations in Japan is mainly due to the active promotion by the Ministry of International Trade and Industry (MITI) of Japan, after the experience learnt in relation to the ISO 9000 certification issue, which resulted in loss competitiveness to other registered firms. Similar scenario has also taken place in Taiwan (Demas *et al.,* 2004). So far, there are several reasons in which a country is promoting the adoption of a formal EMS and going for certification. The ISO TC207 refers to the most EMS benefits which any organization could obtain:

1. Assuring customers of the commitment to demonstrable good environmental management.
2. Maintaining good public/community relations.
3. Satisfying investor's critical and improving access to capital.
4. Obtaining insurance at reasonable cost.
5. Enhancing image and market share.
6. Meeting vendor's certification criteria.
7. Improving cost control.
8. Reducing incidents which result in liability.

Moreover, a study carried out by Melnyk *et al*., 2003 in Chubu region of Central Japan revealed that among the reasons given by firms for the implementation of the ISO 14001 EMS include:

1. Improving the environmental aspects of the firm;
2. Enhancing environmental awareness and environmental capacity-building among employees;
3. Enhancing the public image of the firms; and

4. Improving the management system in the environment system of the environment in the firms.

The core issue is not achieved yet and EMS is still critical to attempt firms in reducing or eliminating the waste and pollution created by the fabrication, use, and disposal of a product. However, the benefit of having Services from either local or international markets was not their main goal. In a study achieved by Mohammed, 2000 shows that only 10% of the respondents stated that ISO 14001 would give them new market opportunities (Figure 6).

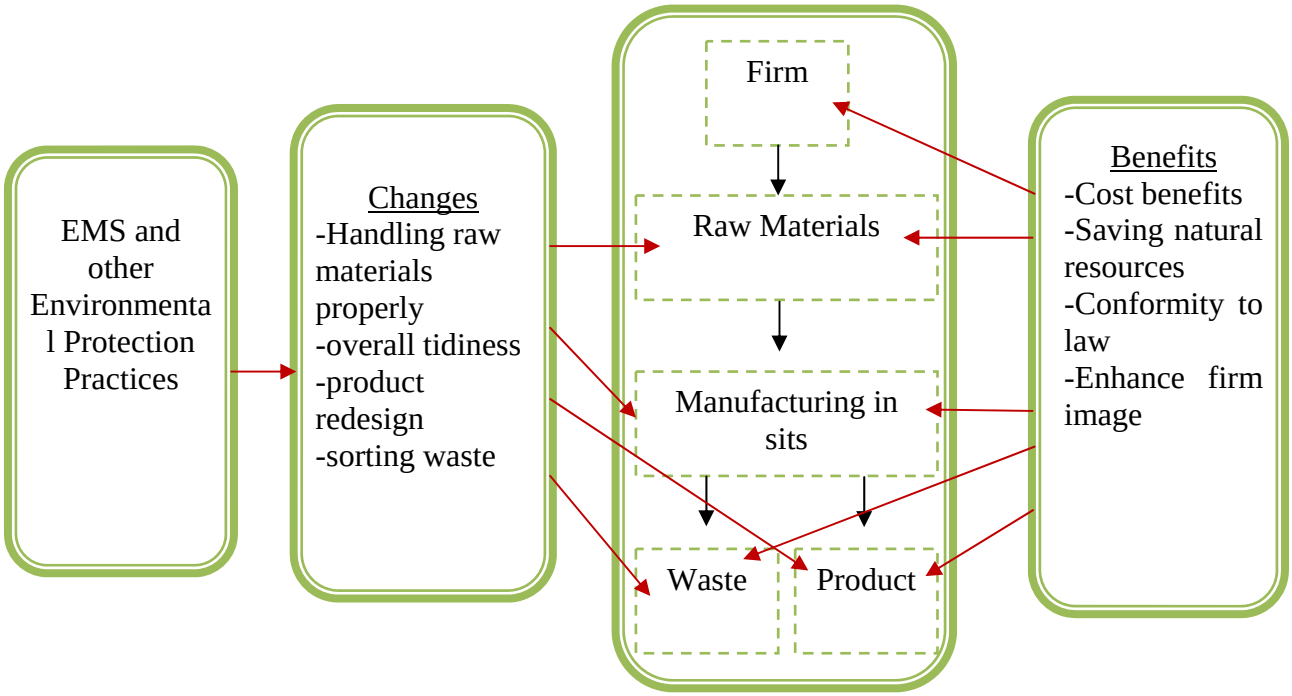

Figure 6: The actions of an enterprise with EMS, adapted from Pun *et al.* 2002.

Based on a survey conducted by the International Islamic University Malaysia (IIU), on 137 ISO 14001 certified companies in Malaysia, it was obvious that the implementation of the EMS in these organizations gave positive impacts or benefits to these organizations, especially in enhancing reputation of the company. Other major benefits stated included reducing waste, improved companies' position in the marketing, looking for alternative technologies and other benefits (Sulaiman *et al*., 2002). On the other hand, the motivation factors to implement ISO 14001 in Hong Kong are mainly to gain larger market share, as indicated by 9% of the respondents. Nevertheless, environmental legislation compliance was only voted as the fifth motivation factor (50% of the respondents) among the surveyed companies. The study also revealed that among the actual benefits gained by the certified companies in Hong Kong the cost reduction was (79%), management efficiency and improvement of public image (71%), environmental impact reduction (43%), and increased employees' environmental awareness (36%) (Chan & Li, 2001). In eleven countries in Europe a survey was carried out on showed that the major forces which motivated companies to adopt EMS were national regulations (83.5%), organizations' directors or owners (70.15%), international regulations (64.5%), and voluntary agreements and local population (56.2%) (Rivera-Camino, 2001).

The monetary and non-monetary benefits of the EMS have also been assessed, in a survey conducted by Hamschmidt & Dyllick (2001), on more than 150 ISO 14001 certified companies in Switzerland. The findings of the survey indicated that the empirically determined mean annual benefit was 167,000 Swiss francs (CHF 167,000), with an average payback period of 2.2 years. These figures were merely based on a bold estimation, as only 6% of the companies surveyed measured the

benefits, 47% estimated and 47% did not answer the questions. In the same survey, the most important non-monetary benefit of implementing EMS indicated was the systematization of the already existing environmental activities, which was as 76%. This was followed by the assurance of legal compliance (59%) and risk minimization (58%) (Hamschmidt & Dyllick, 2001). The reviewed studies indicate that the influencing factors in the implementation of ISO 14001 are different and varied among the countries and the actual benefits. Therefore, it is important to highlight that since ISO 14001 is a voluntary standard, the driving force or the influencing factors for adoption may also change, as indicated in the study conducted in understanding the ISO 14001 adoption behavior among four industries-chemical, electronics, electric machinery, and electric power of Japanese firms (Welch *et al*., 2002).

2.3 The Key factors for success implementation for Environmental Management Practices

To obtain better integration of environmental management practices in the company systems, the requirements of the implementation of EMS can be found in the following five management principles:

1. Commitment and policy: the implementation of policy which demonstrates the environmental commitment;
2. Planning: define the plans and objectives for the assessment of the environmental situation;

3. Implementation and operation: : implement the new management practices regularly and monitor the a significant impact on the environment in which need to receive the required training and information;
4. Checking and corrective action: address the discharges to the environment through systematically measuring and comparison with targets;
5. Management review and continual improvement: review the regular environmental audits and management periodically.

These principles, likewise, form the basis for the EMS implementation which, through its use of checklists, conforms to the main guidelines of the traditional management. The starting point of this literature was the development of an “environmental” policy, based on both the external and the internal environmental situation of companies. This policy is then embodied in plans, procedures, and a monitoring and measurement system. This control system provides input for the audits and review of a company's environmental management, in accordance with a “continual improvement” process. Moreover, this whole system is orchestrated by “plan-do-check” principles, and by a mechanistic process which was modeled based on the traditional management. This considered as the “one best way” to conduct environmental management, all deviations from these managing principles must be treated as “non-conformities.”

The development of the International Organization for Standardization (ISO) standards for the management systems “metastandards” contributes to the standardizing of management practices using a predefined model. The “metastandards” cannot be taken under consideration. The behavioral complexity of an organization, practices specific to certain companies or activity sectors (ISO

2001). Hillary (1999), states that companies which have not developed an environmental management system; and the ISO 14001 system may offer a structured framework that helps to guide the main stages of the implementation and monitoring of an environmental policy. The simplicity and lack of innovation of the framework primarily reflect the wish of the standard's designers to propose a management system which is easier to understand and use to different sorts of companies. This includes small and medium-sized firms (SMFs), in which environmental management is often not well-structured. Companies, which already have a well-established environmental management system, standards may constitute a tool for the evaluation, recognition and improvement of the existing system.

Since the requirements of ISO 14001 are based on a “top-down” approach and on the traditional principles of order and discipline, its implementation gives organizations considerable latitude (Hillary, 1999). These organizations may thus request a participate employees to a fair extent to control the required mechanisms by used standard. The mobilizing, rallying character of environmental issues, which constitute an important concern outside of the work place, can facilitate this participatory approach. The internal implications of the implementation of the ISO 14001 system are therefore not predetermined. They depend, in particular, on the role played by employees in this process and on how well the requirements of the standard can be adapted to a company's culture and the leadership of its executives. The internal needs, which lead to the systematic development of environmental policies, are not the sole factors involved in the implementation of an ISO 14001 EMS. This implementation is also part of a strategic approach with the objectives that go beyond ecological concerns. The motivations, which lead a particular

company to adopt an ISO 14001 environmental management system, generally involve two dimensions, which are traditionally taken into consideration in a company's strategic analysis of its external environment (Andrews, 2001), include:

1. Ward-off threats by responding to societal pressure, anticipating regulatory standards, reducing the risk of crises, etc.;
2. Seize opportunities by improving the companies' image, meeting clients' demands, conserving resources and energy, reducing de-pollution costs, etc.

These motivations cannot be solely explained in terms of local pressure. The intended international application of ISO 14001, its development in many countries and its adoption by a growing number of multi-national firms suggest that adhesion to this standard is a response to concerns which transcend national borders.

ISO's recognition by international markets and its utilization, is a new contractual requirement, depend mainly on its development in the leading industrialized countries as both systems for internal company management and a substitute for the national standards. In the same way as most of the other standards issued by the ISO 14001 was developed in order to avoid the interfering between different environmental management practices. In this case, and in the area of environmental management, create unnecessary barriers for the growth of international trade. This is the objective that ISO hoped to achieve when it proposed, in its mission statement, i.e. to "promote standardization and related activities in order to facilitate international exchange of goods and services." This mission cannot be fully achieved unless two conditions are met: first, the 111 countries constituting the organization must reach a common agreement to accept the new standards as the universal model; and second, the use of these standards must become widespread in industry.

Although the launching of the ISO 14001 standard was relatively recent, both these conditions are on their way to being met. On the one hand, most of the national standards dealing with environmental management, such as France's X 30-200 standard which was issued in 1993, Britain's BS 7750, in 1992, or even Canada's Z750 standard, in effect since 1994, are used less and less often by companies. This is due to the fact that it is recognized internationally, and national companies now often prefer to adopt the ISO standard before their own national standards (ISO final report 2006). Consequently, the ISO 14001 certification of companies is undergoing exponential growth.

2.4 The Reasons for the Adaptation of Advanced Environmental Management Practices

Since the industrial revolution, the goal of the economic growth is to improve the environmental quality. The rise of industries such as steel, chemicals, automobiles, and electricity increased wealth, productivity, profit, and adverse environmental outcomes. This stark trade-off between economy and environment was particularly evident in industrial regions, which grew and prospered around resource extraction and heavy manufacturing. In such places, the environment was often seen as something which could be sacrificed in the pursuit of economic growth.

Out of this context, grew the aggressive environmental policies and regulations of the late twentieth century, which addressed the economy-environment relationship by imposing strict limits on the waste and emissions produced important gains. As a leading commentators around the world have noted, this command-and-control

approach to environmental policy may have reached the point of diminishing returns (Strasser, 1996).

Leading corporations, in the United States and around the world, are pioneering new strategies for integrating the environment into their overall business strategy; and for simultaneously improve their environmental and business performance (Porter and Claas, 1995). The main goal of many firms is to becoming leaner and greener at the same time (Flodida, 1996). These companies are motivated not by the altruistic concerns, but also by the bottom-line drive to increase profits, productivity, and performance by reducing waste and emissions. Around the world, a “three-zero” manufacturing paradigm is emerging, where companies simultaneously work to achieve zero defects (quality), zero inventory (just-in-time inventory and supplier relations), and zero waste and emissions, which is tend to be well documented.

Little researches are found regarding to the ways which innovative plants interact with their surrounding communities. At the same time, it is still questionable whether high-performance manufacturing facilities are more likely to be better corporate citizens than their less innovative counterparts. The aim of inventing a new approach of environmental practices is to manage business goals and environmental performance. EMSs are like other management systems, which are formal systems for articulation goals, making choices, gathering information, measuring progress, and improving performance; they are recognized as systematic and comprehensive mechanisms for improving environmental and business performance. The EMSs represent an extension of the core principles of the total quality programs to environmental management in many ways. Lookman *et al.* (1998) established a modern environmentally sound called “coal-fired power” plants in India. This

introduced method imposes low cost for energy generation and its economic impediment to implement these methods. As a consequence, the results showed that the use of system approach, including pre-combusting and post-combusting, could control air pollution. Approximately 0.4-0.7$ billion annually since 2002 spend on developing control management in the suggested “coal-fired power” plants. The government policymakers are interested in the EMSs, as a possible supplement to or replacement for the so-called command-and-control environmental regulation. In addition, the benefits of pollution prevention programs are used in conjunction with the EMSs. The United States Environmental Protection Agency (USEPA) defines Pollution Prevention (P2) as a “source reduction-preventing or reducing waste where it originates, at the source-including practices, that conserve natural resources by reducing or eliminating pollutants through increased efficiency in the use of raw materials, energy, water, and land.” A study was carried out at the North America’s gold mining industry, by Hilson and Murck (2001), indicate that the evaluation of the progress is going toward pollution prevention and waste minimization technologies. Based on that, Hilson and Murck (2001) believed that any company, which is not interested in developing environmental management practice in their industry, will face a dramatic problem in controlling their business within the need of the regulations. On the other hand, an incentive study was carried by the Industry Level, Jung *et al*. (1996) to evaluate four environmental policies which influenced the development and settlement pollution prevention technologies. The findings showed that the importance of the fourth policies in making the development in the organization or the firm. The arrays of the four environmental policies, after the evaluation, are the following: (1) auctioned permits; (2) emissions taxes and

subsidies; (3) Issued marketable permits; and (4) performance standards. In addition, Hettige e*t al*. (1996) stated that, “pollution intensity is negatively associated with scale, productive efficiency, and the use of new process technology”, while it is positively associated with “public ownership” more than “foreign ownership.” As a consequence, Christmann (2000) pointed out the influence of best practices of environmental protection activity to gain cost advantages. The capabilities for innovation and implementation advanced protection processes can significantly affect in the relationship between the best practices and the cost advantage, to determine the firm’s environmental performance.

2.5 The Incentive Elements to Adopt Advanced Environmental Management Practices

In order to enhance the adoption of the advanced environmental practices, organizations should introduce the specific elements to encourage successful implementation and development. Pun *et al*. (2002) argued that factors such as management commitment, organizational control, external and internal communication and technical approach might determine the success of the EMS adoption, implementation, and development.

2.5.1 Management Commitment (MC)

The successful development designed and implementation of the EMS, in any organization, is dependent on the approach of the top management (Mitsuhashi, 1998). The best management approach can be seen in the form of commitment and support, appropriate environmental policy which is accepted by every employee in

the organization, and regular management reviews. The type of management, which provides a surface service to ISO 14001, is probably not succeeding. Only those executives who are enthusiastic about ISO 14001 and commit their full support to enduring organizational changes, associated with the implementation, can lead to a continual improvement in environmental performance (Teck and Peng, 2001). The lack of regulatory commitment is not necessarily reduces the innovation of the environmental management technology. Although an endogenous regulatory standard can reduce incentives to innovate and ratchet up the standard, a countervailing raise rival's cost effect can mitigate these low incentives. Rules are not necessarily better than discretion for environmental regulation in oligopoly settings (Puller, 2006). The environmental policy represents a serious commitment on behalf of the company, in which every word and phrase is carefully thought through and its implications are fully understood (Mitsuhashi, 1998). The policy forms the basis, on which the organization sets its environmental objectives and targets. The best management plan must actively participate in the development of the policy and must make sure that it is communicated at all levels in the organization. It also must review continuously the EMS of the company so as to ensure that the system is suitable, adequate, and effective (Petroni, 2001).

2.5.2 Organizational Control (OC)

Organizational changes include aspects such as defining clear-cut responsibilities, conducting proper training and increase awareness of employees, having proper communication channels, documenting and controlling the processes, as well as having proper emergency preparedness procedures. The best management plan must

ensure that the changes are clearly understood and supported by all employees in the organization and reviewed at regular intervals against the objective and targets of the environmental performance established in the environmental policy.

Radonji & Tominc (2007), point that the successful EMS development requires commitment from all employees and the environmental responsibilities which must clearly be defined and communicated. These may entail changing the structure and communication channels. The requirements of the ISO 14001 standard help organizations to establish management activities for controlling and improving their environmental performance and reduce their overall impact on the environment. On the other hand, upgrading of technology is one of the most important areas for industry, not only because of the environmental requirements, but also because of the increasing productivity and quality, as well as lowering the operational costs (Radonji and Tominc, 2007). Implementing the EMSs can assist organizations to improve the efficiency of their resource and reduce bottom line costs. At the same time, they can also help conformity with customers' requirements in the supply chain, enable sustainable procurement policies, enhance an organization's reputation, secure new markets, and help improve communication with employees, regulators, investors, and other stakeholders (Thomas, 2008).

Clement (1996) introduced the requirements necessitated by any organization to enhance the development of the EMS. These requirements include education and training (which are required to enhance the competencies of the staff and must be clearly identified by the management); training (which must include environmental policy and the EMS requirements, relevant objectives and targets, job specific environmental effects, benefits of improved performance, and consequences of the

non-compliance as the level of training and awareness which directly have bearing on the success of implementation and the level of preparedness, in case of any mishaps); the organizations implementing EMS must establish and maintain procedures for both internal and external communication about the EMS; the procedures for controlling all the EMS documents must be established and properly maintained by the organization; and the organization must establish and maintain procedures to identify and respond to accidents and emergency situations. The organization must also develop, establish, and maintain procedures for preventing and mitigating the environmental impacts which may be associated with accidents and emergency situations. These procedures must be tested, reviewed and revised (if/when necessary), after the occurrence of accidents or emergency situations (Clement, 1996). Generally, organizational preparedness of emergency situations is a key factor of organizational change.

2.5.3 External and Internal Communication (EIC)

The effective development and implementation of the EMS is influenced by the external and social aspects which include environmental legislation, market pressure, customer requirements, and employee relations (Lin, 1995). Many countries, including developing countries like Malaysia, have enacted strict environmental legislation to prevent environmental damage and to punish the offenders. EMS helps organizations to adhere to the guidelines laid down in the legislation. Growing pressure by such legislation has forced companies to adopt a comprehensive EMS and provide confidence to all the stakeholders and regulators (Thornton R. 2000).

An organization, which is committed to the environment, is more likely to bolster team spirit and engender loyalty and increase its ability to attract high quality staff (Sayre, 1996). Reactive integration is achieved when internal and external motivations are weak, and when the implementation of the standard becomes more difficult to implement, except in the reaction to unexpected changes. These changes might occur, with respect to customer demand, the attitude of public authorities or competition. Similarly, the opinions of the executives and employees, regarding this system, are not fixed in stone and can change in favor of the standard (Boiral, 2001).

The developed implementation from EMS is a good demonstration of such a commitment. High quality staff and their loyalty are likely improving the employees' relations within the organization and this makes the implementation of the advanced EMS much easier. The new quality standards for the environment are the result of recent developments for standardization on the environmental front, as they provide valuable resources for efficient management (Andrews *et al.,* 2001). The manufacturing and service sector companies feel the strong market pressure to implement such environmental quality standards (ISO 14001) in order to do business in international markets (Delmas, 2002). In addition, Clark *et al.* (2003) pointed out that many multinational companies are adopting the EMS in response to the pressure from their customers. Radonji & Tominc (2007) indicated that companies nowadays have started to instruct their suppliers to conform to the ISO 14001 standard. Furthermore, Puller (2006) claimed that the international standard could help corporations to simplify and integrate their environmental protection programs into a more coherent framework. Melnyk *et al.* (2003) stated that the standard is a way of introducing a structure into a company in order to achieve more effective control.

2.5.4 Technical Approach (TA)

The effective implementation of the advanced EMS in manufacturing and service industries hinges on integrating it with the technical aspects (Clements, 1996). The technical aspects include the assistance from environmental specialists, availability of monitoring and measuring equipment, and the production process enhancement. Adopting an EMS (ISO 14001) is an important technical aspect because it is an instrument which functions at the micro level, while functioning within the scope of a macro level tool. When the participation of the SMEs is considered, this is even more relevant because of their larger number and production of a greater diversity of pollutants.

Legally established environmental standards do not consider the potential environmental damage associated with the cumulative effect, synergism and/or the reactivity of the compounds, within a particular environment (air, water, soil). This emphasizes the need to develop simpler and more appropriate methodologies for the implementation of the EMS in this context. The methodology used for the EIE discussed here is, and a part of a global model for implementing EMS, developed to render the process for the EIE, the objective and simple so as to meet the needs of the SMEs by adopting a cooperative implementation model (Seiffert, 2008).

A common problem faced by many companies is the lack of knowledge about pollution control technologies, risk assessment and control, and management (Lin, 1995). Hence, there is a demand for a specialist's assistance in understanding and assessing technical issues of the organization's operations which may have significant environmental impacts. The specialists help organizations to develop and implement response actions to improve the environmental performance of

organizations in a practical manner leading to compliance with environmental legislation. In fact, the implementation of the advanced EMS requires reliable monitoring and measuring equipments to regularly monitor and measure all the activities which can cause significant impact on the environment. The equipment used must enable the organization to record information to track performance, execute relevant operational controls and assess conformance with the objectives and targets of the organization. These monitoring and controlling mechanisms can be used to enhance production processes so that they can become more environmentally friendly.

2.5.5 Economic Valued (EV)

A central theme of sustainable development is the integration of economic, social and environmental concerns. In the of Agenda 21/UN 1992/Chapter 8, agreed to at the Earth Summit on Integrating Environment and Development in Decision-making, states that, “the first step towards the integration of sustainability into economic management is the establishment of better measurement of the crucial role of the environment as a source of natural capital and as a sink for by-products generated during the production of man-made capital and other human activities.”

In this view, integrating environment and economy means appreciating the role of the environment as a component of the economic system which provides raw materials for production, and as a receptacle for wastes from production. Zutshi & Sohal (2004), in their report on sustainable development, interpreted the principles of sustainable development as recognizing that resources and environments serve economic functions and have positive economic value. Similarly, Sammalisto &

Brorson (2008) stated, in his text on environmental economics, that “clearly the natural environment is an important component of the economic systems, and without the natural environment, the economic system would not be able to function. Hence, we need to treat the natural environment in the same way as we treat labor and capital; that is as an asset and a resource.”

Implications of the regulatory policy are a critical component of the optimal regulation. In particular, regulatory commitment, through legislation or bureaucratic procedures, is not necessarily critical in oligopoly settings. However, in monopoly settings, the incentive to suppress innovation may justify funding for ‘‘public interest’’ research and development. Therefore, it would be informative to test for empirical evidence of strategic behavior between firms and regulators which is consistent with this model. The econometric challenge in designing such tests is to identify a set of firms facing both endogenous and exogenous regulation, and regulators with varying degrees of commitment (Puller, 2006).

In a way, the ISO 14000 certification process forces companies to examine all areas in order to determine potential environmental impacts and set improvement objectives. As companies explored territories which expanded beyond manufacturing, opportunities to reduce pollution and cut costs frequently turned up. As goals were set in areas outside the traditional manufacturing/environmental arena, there was a re-examination of accepted norms and practices, resulting in unanticipated business benefits (Curkovic *et al*., 2005). Moreover, Curkovic *et al*. (2005) state that ISO 14000 is a trend in the environmental management which cannot be ignored. In fact, for those companies which wish to remain competitive and improve their environmental systems, it can be an invaluable tool. Many

managers warned that the ISO 14000 certification can result in non-value added costs, if it was pursued only for its marketing or regulatory appeal. The true commercial value associated with ISO 14000 can only be achieved when it is made consistent with a company's strategic direction (this means using the ISO 14000 standards as a foundation for a much broader system such as the TQEM). The experiences of these companies can serve as an illustration for organizations contemplating in pursuing certification. Consequently, ISO 14000 can help an organization not only to reduce waste, but also gain a competitive advantage in the international marketplace through its standardization of the environmental systems through its standardization of environmental systems.

2.6 Summary

The importance of using EMS contribute strongly with the asses and control the industrial production as well as improve the harmful substance from destroying the environment. Mainly, the previous studies in this chapter agreed that the EMS is the perfect chaise to gain environmental sustainability. Likely, economical benefits are achieved from using EMS, such as diminish raw materials purchases, decrease industrial waste, reduce the amount of money spend on waste recycling, minimize the consumption of water/fuel/ electricity,...etc. Along with the economical benefits, ecological benefits are also affective. The most important ecological benefit of using EMS is providing strict rules to protect the sounding environment. Also social benefits of using EMS are indicated, include enhance companies' image, open doors towered global marketing, and emphasize the consumers toward green products. In

this term we can understand the correlation between the uses of EMS as eco-socio-economics.

This generalizes the application of the EMS principles in which are involved in different kinds of industrial activities. Thus highlight the fact that environmental policies, programs, procedures, and monitoring are not the sole factors of EMS implementation. It probably needs more strategic approaches with objectives that go beyond the ecological concerns.

CHAPTER 3

MATERIALS AND METHOD

3 Introduction

In this chapter, the methodological design and approaches used in the study are described in order to reach the objectives and research questions of this thesis. The chapter starts with the description of the research design and this followed by the data collection and analysis which were carried out in this study. The method used in this study is known as the environmental quantitative and qualitative survey, which was carried out at the Kamunting industrial zone; whereas, the materials included the collection of the data from the questionnaire, organizations' sources (WISMA), and internet search. The survey items in the questionnaires are found to be of high dependency, valid and can therefore be used for further research (Sammalisto and Brorson 2008).

3.1 Kamunting Industrial Zone (KIZ):

Kamunting Industrial Zone (KIZ) is located in Taiping, state of Perak. It is one of the biggest industrial zones in the state. Malaysian Department of Environment (DOE) issued this zone for more than 100 industries by 2000. (Figure 7 & 8)

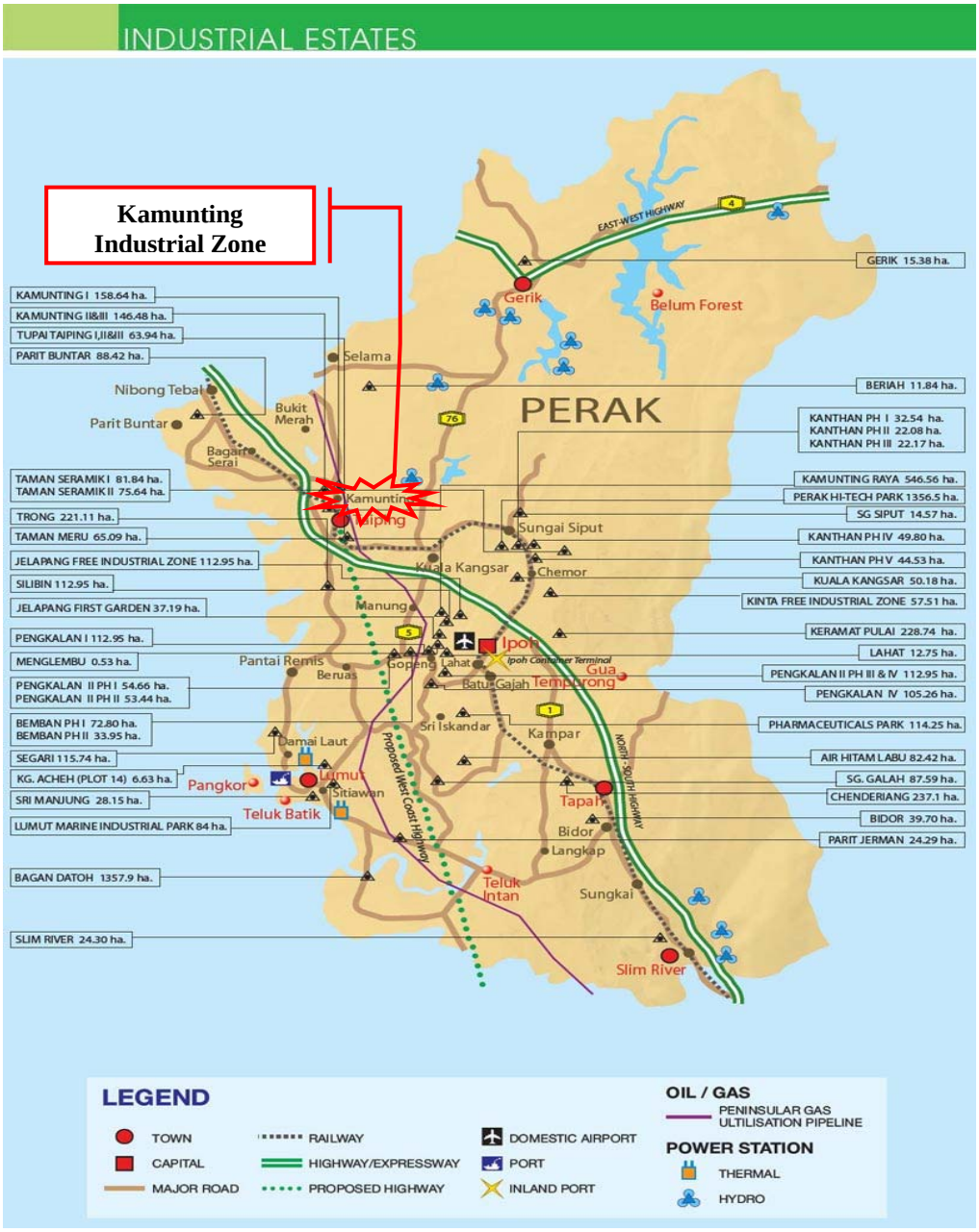

Figure 7: State of Perak/ Kamunting, adopted from www.investperak.gov.my

Figure 8: Kamunting Industrial Zone, adopted from www.arth.Google.com

3.2 Research Design

This study was principally based upon a survey of manufacturing establishments. The survey collected information on various aspects, which include; (1) adoption of advanced environmental and management practices and its cost (e.g. environmental management systems, pollution prevention, quality management, ISO 14000, etc.), (2) community environmental impacts (e.g. waste and emission streams, noise, odor, and employment), (3) the amount spent annually by the industry in protecting the environment, and (4) the benefits from actions taken during the year which reduce the impact on the environment (e.g. saving from using raw materials more efficiently).

The survey was conducted at the Kamunting industrial zone 2007; where were about 83 firms in operation status. The survey instrument was questionnaire; however, copies were distributed to only 45 firms after their agreement for face-to-face interview, while the rest was disagreeing. Based on the initial investigation done, the survey item is found to be high dependency, valid and can therefore be used for further research.

3.3 Data Collection

Two methods were used to obtain the necessary data for this study. The first component of data collection for this research paper was based on the collection of the primary data from a survey questionnaire. As mentioned previously, copies of the questionnaire were distributed via face-to-face interview considers as an administrative survey method. In total, 45 surveyed forms with a response rate of 80%. This method is important to familiarize with the current situation of the pointed

firms and illustrate the practices of the companies which are related to the firms and environment performance.

The second component of data collection was the collection of the secondary data from the DOE Environmental Quality Report so as to compare the biochemical parameters such as the Biological Oxygen Demand (BOD), chemical oxygen demand (COD), Total Suspended Solid (TSS), etc., with the data obtained from the firms to find out whether the effluents from the firms were within the stated standard.

3.4 The Questionnaire

The questions were aimed to identify as many environmental issues as possible and isolate areas where these issues could be resolved or improved. A sample of the questionnaire is attached in Appendix 2.

Generally, the questionnaire consists of nine parts; the first section included questions related to the operation status of the firms, including the initial capital of the firm and other developed budget. The second section was about the pollution abatement, disposal and recycling policies information. Meanwhile, the third part was about the expenditure associated with the operation of pollution control of abatement equipment (end-of-pipe), and the fourth was on the integrated pollution prevention techniques/ integrated capital expenditure. Part Five was specifically meant for cost savings or income arising from the expenditure or process changes taken in 2006, which resulted in environmental improvements, and Part Six was designed to gather other information on the expenditure for environmental protection such as tax credits and subsidies. The firms' environmental reporting and auditing systems were integrated in Part Seven, whereas the amount of other payments in the

appropriate categories was included in Part Eight. Finally, Part Nine focused specifically on additional and pertinent information.

3.5 Data Analysis

In the current research study, two types of analysis programmers were administered, namely: Microsoft Excel analysis program (Exl.) and Statistical Package for Social Science (SPSS) computer program. These programs were chosen because they show better understanding for data's frequency as well as provide full description for the result of the collected data. Excel was used to present data from questionnaire in general and in different kind of charts as an independent variable. While SPSS used to test the Bio-Economic models. SPSS works on the internal file structure, data types, data processing and matching files, which altogether considered a datasets. These datasets consist of a 2-dimensional table structure, where the rows typically represented as individuals (independent) and the columns represented the measurements (dependent), see Appendix 2. Thus, only 2 data types were defined; these were numeric and text. All data processing occurred sequentially case-by-case through the file. This means the files could be matched one-to-one and one-to-many, but not many-to-many. The analysis of the correlation using Person Correlation helped to explain the relationship between the independent and the dependent variables. For this, the level of significance used was 95% in the current research.

3.6 Bio-Economic Model

This section was carried out to understand how information, which was collected through data collection methods, was used for economically for environmental reporting. Since the focus of this research study was related to the firms and their

environmental performance, this section is thus far confined to compare and analyze data so as to obtain the actual understanding of the relation between the economy and the Biology of the environment in choosing area. Similarly, this can facilitate in the interpretation of the collected data on the firms, and the issues in environmental protection. Therefore, the information gathered proved to be very useful, especially the diffusion of the knowledge about environmental management practices and their benefits.

CHAPTER 4

RESULTS AND ANALYSIS

4 Introduction

This chapter presents the results and data analysis based on the models discussed in Chapter 3 and highlights the impacts of implementing the EMS and ISO 14001, using Cleaner Production Technology (CP) and End-of-Pipe Technology (EOP) in addressing the environmental technological sources. The benefits as well as general comparisons of each technology will be presented in this chapter. In addition, the base line data will be reviewed, and this is followed by the analysis of Bio-Economic model.

4.1 Baseline of Results

The survey consists of nine sections, which include information on the firms, expenditure, pollution activities and abatement facilities, the types of waste treatment technology, the total cost of pollution abatement, the total cost for saving money, the total credit taxes, other taxes payment, the total capacity of treatment pond, and criteria of water quality which consists Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), as well as Oil and Grease (O&G).

4.1.1 Firm Activities and Size

The survey showed that only 3 firms have a specific environmental section handing various environmental issues, and about 6 firms have a small office specifically

meant for handling waste disposal, while 36 firms have no specific place to deal with environment-related issues. The survey indicated different types of firm activities, and these vary from chemical, electronic to food oil palm (Figure 9).

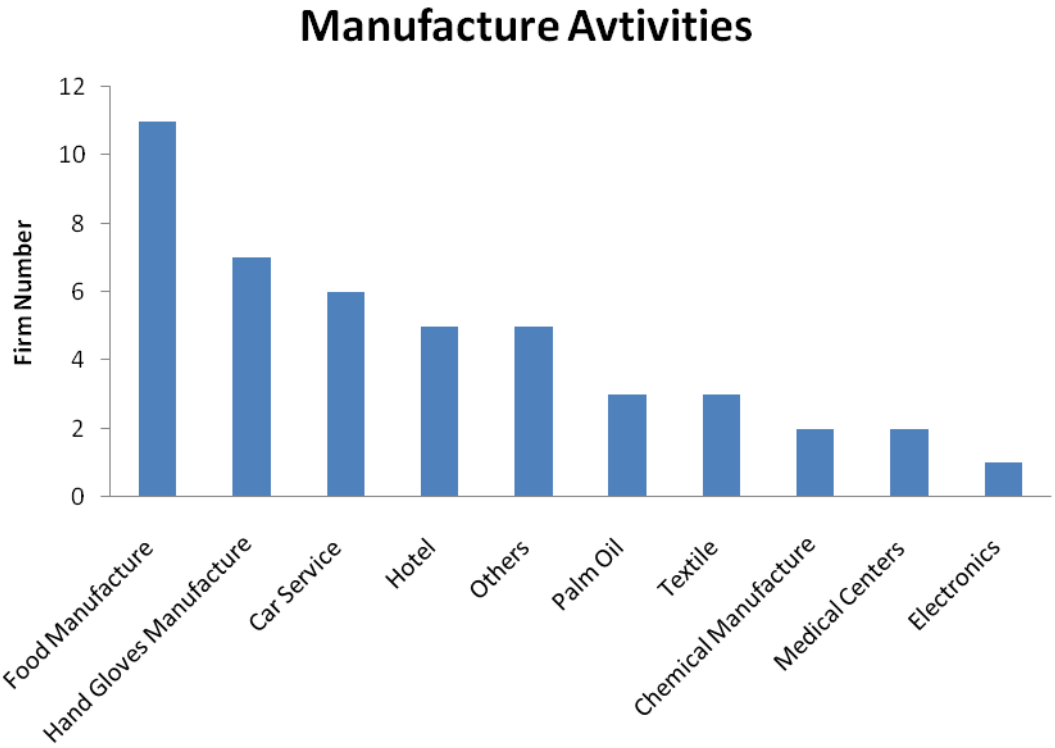

Figure 9: Technical sectors and firms

From the above figure, 24% firms involved in the Food/Restaurant and food-based products, 15% firms were specialists in hand gloves manufacturing, car service centers (13%), hotels (10%), palm oil manufacturers (8%), textile manufacturers (8%), chemical product manufacturers 5%, Medical Centers (5%), electronic manufacturers (2%), and manufacturers of other products (10%).

Based on the above results, 49% of the firms dealt with chemicals as an essential material in their product activity, such as paper recycling, leather tapping, laundry, hand gloves, textile, and others. Meanwhile, 44% of the firms dealt with both chemicals and organic materials such as food industries, oil palm manufacturers, and other premix plants. The remaining 7% was dealing with electronics and the production of some medical-related equipment.

On the other hand, the firms can be classified into small, medium, and large size, based on the number of employees and the total capital of the firms in 2006. According to European Union Standard, small enterprises are firms with the employee number lesser than 50, and medium enterprises are the ones which have more than 50 but less than 250 employees, while large enterprises comprise more than 250 employees. The classification size and the total mean capital of the firms are illustrated in Figure 10.

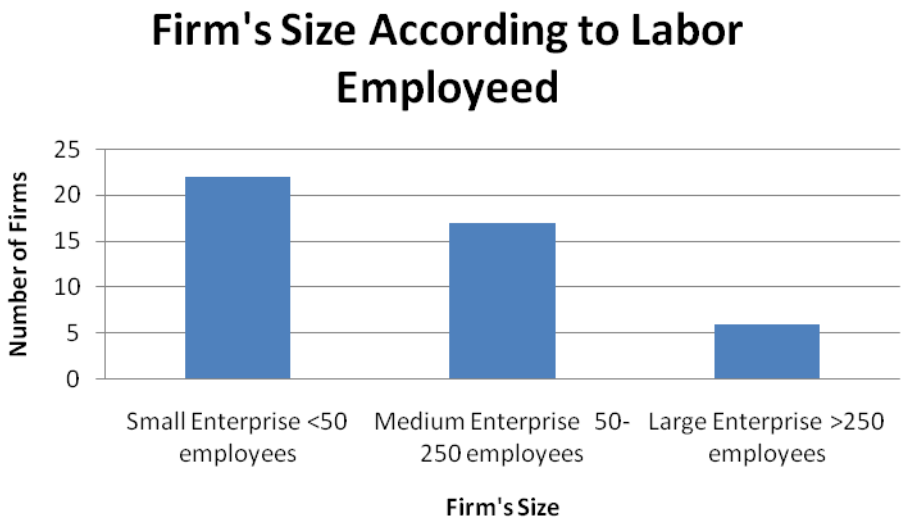

Figure 10: Size of firms in term of labor employees and according to the European Union Standard, the mean total capital fund at 2006.

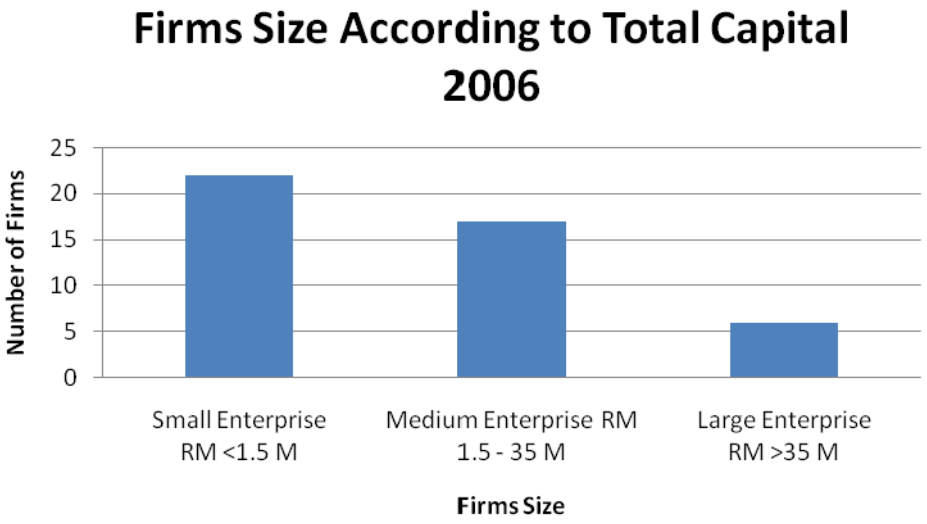

Figure 11: Size of firms in term of total capital fund at 2006.

From the above figure, 49% of the firms are considered as small size enterprises with the average of capital fund less than RM 1.45 million (2006), 37% firms came under medium size enterprises with the average total capital of RM 1.5 – 35 million (2006), and only 14% firms were classified in the large size enterprises with the average total capital of more than RM 36 Million (2006).

4.1.2 Pollution Activities and Abatement Facilities

From the survey, the main four types of pollution are 42% effluent treatment, 32% solid waste disposal, 21% air emission treatment, and 5% toxic water treatment (Figure 11). As for solid waste, 5% of the total solid waste was recycled, 25% was sold to contractors, 15% was sent to incinerator, and 55% was disposed off to the landfill.

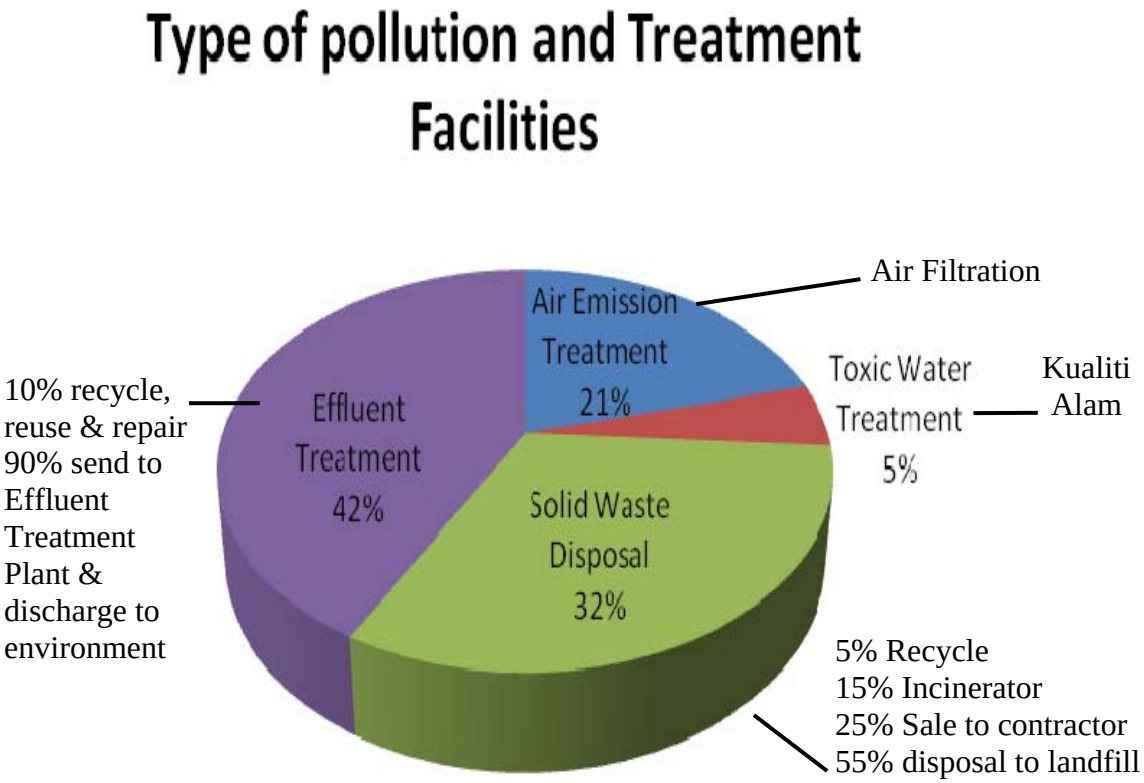

Figure 12: Types of pollution and treatment facilities according to percentage

4.1.3 The Types of Waste Treatment Technology

Three types of technology and management were detected among the surveyed firms; these were End-of-Pipe Technology (EOP), Cleaner Production Technology (CP), and Housekeeping Management (Figure 12).

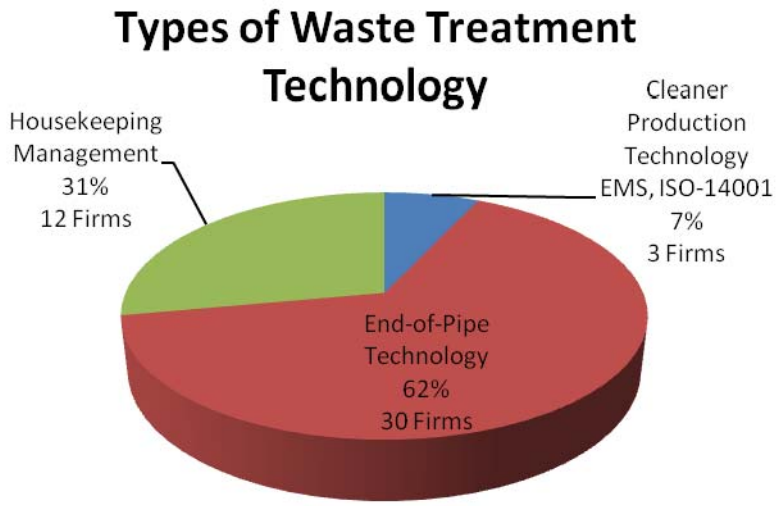

Figure 13: Types of waste treatment technology

The above figure shows the implementation rate of waste treatment technology in which 62% adapted the EOP Technology (30 Firms), while only 7% firms implemented the CP Technology (3 Firms), and around 31% (12 Firms) used Housekeeping Management practices to reduce the consumption of raw materials.

4.1.3 The Total Cost for Pollution Abatement

Each firm has its own method to treat their waste, according to the type of technology they are applying, so that the cost for the treatment of waste can be divided into two categories, as follows:

4.1.3.1 The Waste Treatment Cost Using the EOP Technology

The capital expenditure and operation expenditure for 2006 varied in terms of pollution abatement, as the cost for the treatment of waste ranged from RM 6000 to about RM 43000 (Figure 13).

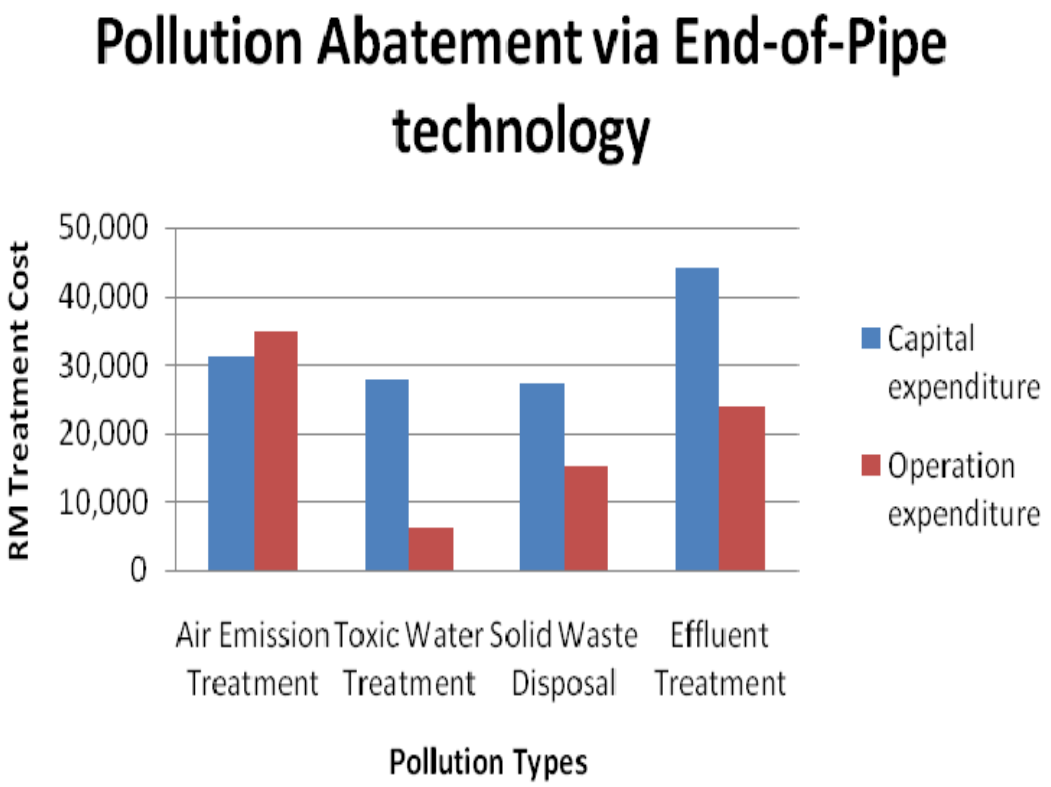

Figure 14: The measures of pollution abatement expenditure by using End-of-Pipe Technique

From the above figure, it is observed that the operation expenditure for the air emission treatment is higher than the capital expenditure by about RM3580. This contradicts with the treatment of toxic waste (with the capital expenditure more than the operational expenditure by RM 21, 560), the treatment of solid waste with the capital expenditure exceeding the operational expenditure of about RM12, 000 while effluent treatment recorded capital spending exceeded operational expenditure by RM20, 180.

4.1.3.2 The Treatment Cost of Waste Using the CP Technology

Capital and operation expenditures using the CP Technology in 2006 are differs as to that end-of-pipe technology (Figure 14). According to the types of pollution, in which the treatment cost for waste ranged from RM10, 000 to about RM180, 000 (Figure 14).

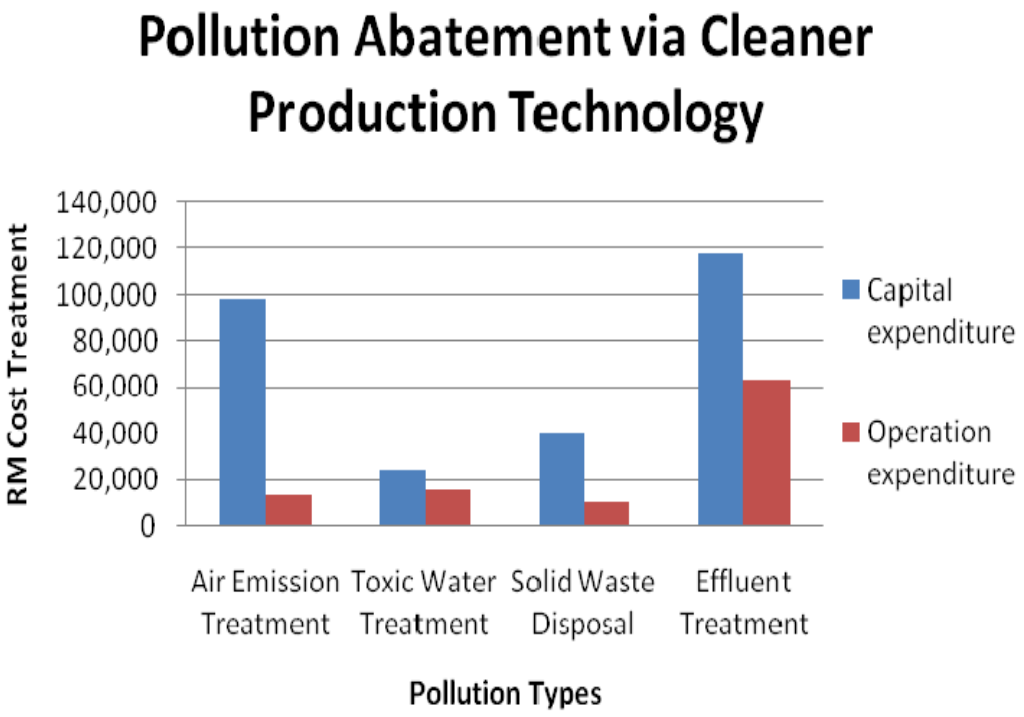

Figure 15: Pollution abatement expenditure using the CP Technique

4.1.3.3 The Total Cost of Saving Measures

Some firms prefer using the Housekeeping Management process such as using alternation options, instead of raw materials, technical management options for water and energy usage, recycling of solid waste, and other options, to gain cost-saving benefits. The survey shows that around 12 firms have obtained this management (Figure 15).

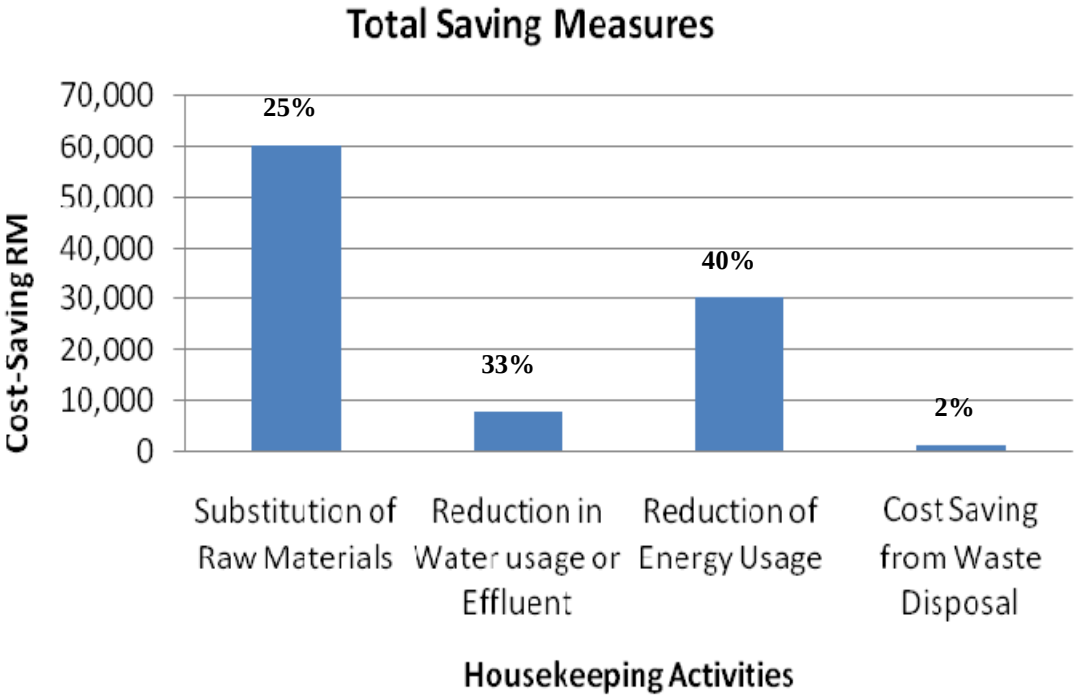

Figure 16: The total cost-saving measures from the housekeeping activities

The above figure shows that 25% of the firms adopting the HMP could save around RM 60,000 from the substitution of raw material. Meanwhile, 33% of the firms saved less than RM10, 000 from the reduction in the amount of water/effluent used. Moreover, 40% saved around RM30, 000 from the reduction in the energy used. Finally, only 2% saved about RM1,000 from the recycling of solid waste.

4.1.4 Total Credit Taxes or Subsidies

The survey showed that only 5 firms, from the housekeeping managed firms, received tax credits for both environmental monitoring/testing activities and the administration of environmental research/conservation project (Figure 16).

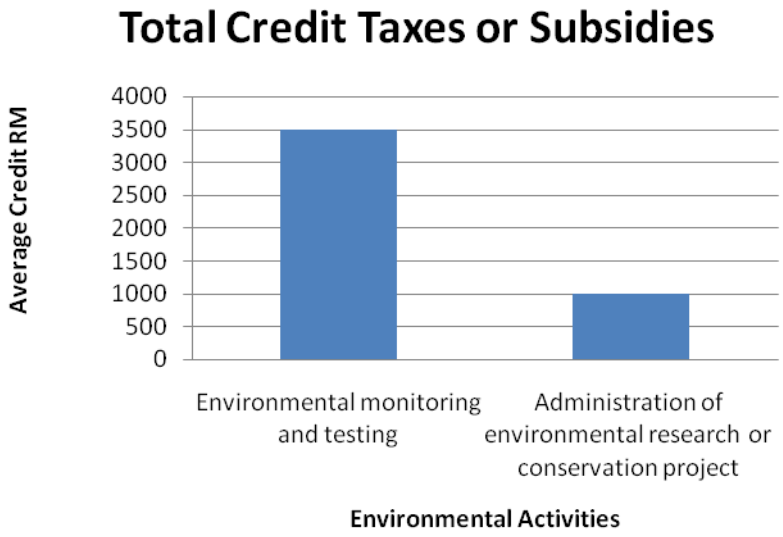

Figure 17: The total RM credits/subsidiaries received for using environmental friendly practices 2006.

The above figure shows that 4 firms received about RM3, 500 in term of credit for applying environmental monitoring and testing activities. In addition to that, only 1 firm received about RM1, 000 for administering environmental research or conservation project.

4.1.5 Other Payment

The survey also showed that all 45 firms had to pay to the government an average sum of RM 6,428 for license processing taxes, while only 3 firms paid an additional of RM10, 333 in terms of fines and penalty taxes (Figure 17).

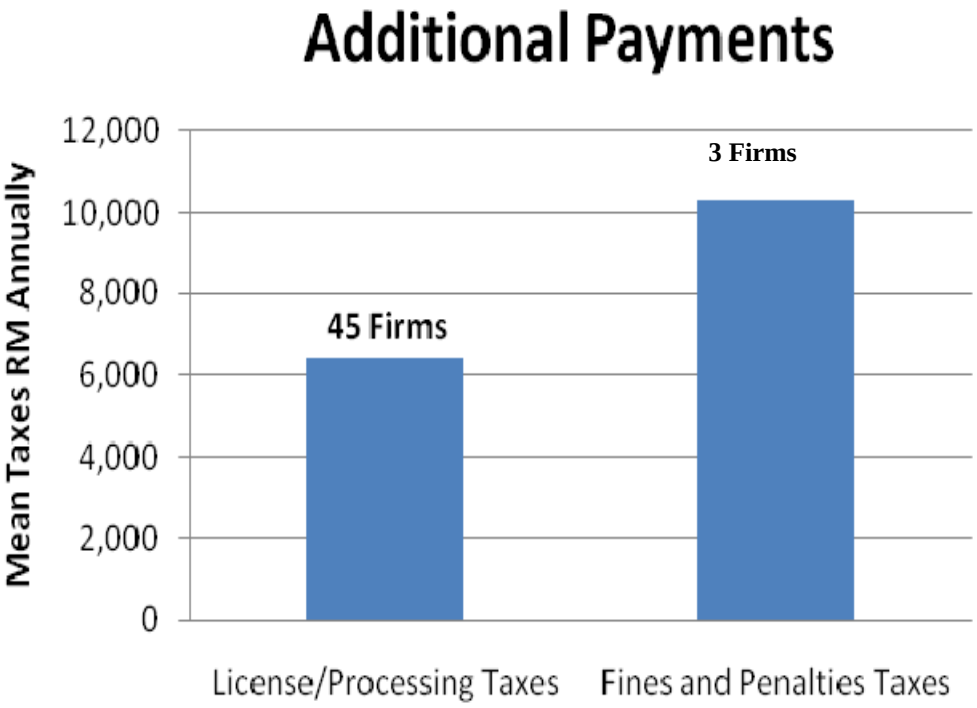

Figure 18: Payment on additional taxes to the government

The above figure shows that 45 firms made an annual payment of around RM6, 000 RM to the government for license and processing taxes, while 3 firms had to pay an annual extra payment of RM10, 000 for fines and penalties taxes.

4.1.6 The Total Capacity of Treatment Pond (m^3/day)

The survey indicates a wide range of capacities to treat ponds for the effluent discharge of accompanies, according to their activities and types of technology used (Figure 18).

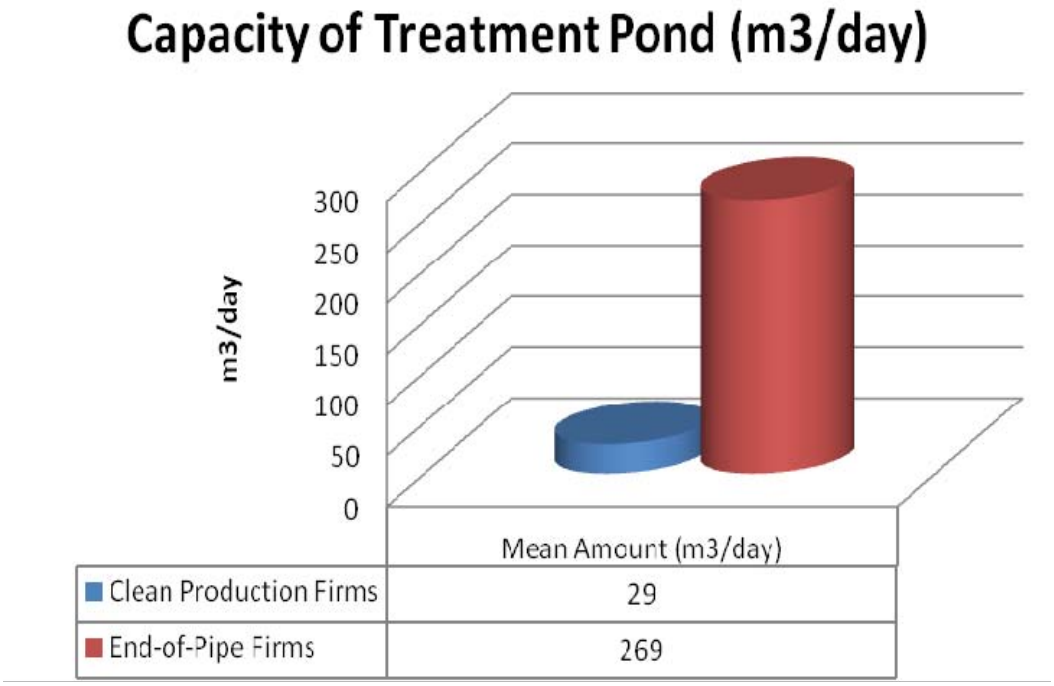

Figure 19: Capacity of treatment pond among firms in 2006

The above figure depicts a huge difference between the mean amount of capacity of the treatment effluent from Clean Production Firms and End-of-Pipe firms, i.e. only 29 m^3/day from the CP firms as compared to 269 m^3/day from the EOP firms.

4.1.7 Water Quality Criteria

The mean amount of water pollutants based on the CP Firms is quite law; BOD: 17 mg/L, COD: 66 mg/L, TSS: 28 mg/L, and O&G: 4 mg/L (Figure 19). On the other hand, the mean amount of water pollutants based on the EOP Firms quite high; BOD: 61 mg/L, COD: 203 mg/L, TSS: 698 mg/L, and O&G: 10 mg/L (Figure 19).

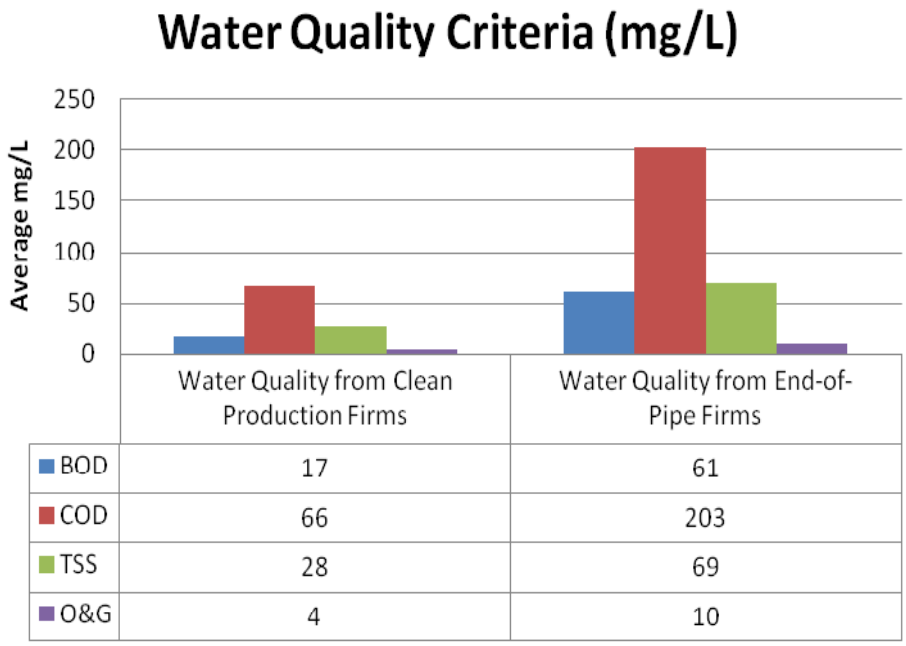

Figure 20: Criteria for water quality from Clean Production and End-of-Pipe Firms

As a consequence of these results, the water quality released is considered under Standard A of the Malaysian Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979. In addition to this, it is also considered as Class IV of the Malaysian (DOE) Water Quality Index Classification.

4.2 Bio-Economic Models

The data analyzed using the SPSS program (as discussed in Chapter 3) was employed to come up with the Bio-Economic models, and for this purpose, the total cost for the treatment of effluent for the BOD control and the cost-benefit saving were used as dependent variables. On the other hand, the implementation of EMS, measures of capacity of treatment pond (m^3/day), water quality parameter measures [BOD, COD, TSS, O&G (mg/L)] were used as independent variables. All analyses were followed by their discussion.

4.2.1 1 Model 1: The Implementation of the EMS Affecting the Cost of Treatment Effluent

The model illustrates the relationship between the adoption of the EMS and the treatment cost of effluent to control BOD, as represented in a simple model of:

$$\mathbf{C_{/BOD=}\ F\ (EMS)}$$

$C_{/BOD}$ = Cost of Treatment Effluent to control BOD

F= indirect relation

EMS= Implementation of EMS

Table 2: The total cost for the treatment of effluent to control BOD and the implementation of the EMS*

Model 1	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	484205.193	123952.983		3.906	.000
Implementation of EMS	-296246.526	474703.785	-.096	-.624	.536

* Dependent Variable: Total Cost for the treatment of effluent

Model 1 shows the Indirect relation between the implementation of EMS and cast of treatment effluents.

4.2.2 Model 2: Implementation of the EMS Affecting the Capacity of the Pond Treatment

This model shows the difference between the End-of-Pipe Technology (EOF) and cleaner Production Technology (CP).

Model 2a: $C_{/BOD=} F\ (Capacity)^{EOP}$

F = direct relation

Capacity= Capacity of treatment pond (m^3/day)

EOP= End-of-Pipe Technology

This model illustrates a direct relationship between the cost of treatment effluent to control BOD, with the effluent capacity of the treatment pond, when using the EOP Technology. However, as much as the cost of treatment plant goes higher, the capacity of effluent also goes higher (Table 3).

Table 3: The treatment effluent cost with the capacity of the pond treatment via End-of-Pipe Technology*

Model 2a	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	14351.195	4524.669		3.172	.003
Capacity (m3/day)	4.050	2.944	.208	1.376	.176

* Dependent Variable: Total Cost for Treatment Effluent

Model 2a shows a direct relation between the capacity of effluent and the cast of effluents treatment.

The situation became different when the CP Technology was used. The model below illustrated the indirect relationship between the costs of the treatment effluent to control BOD with the effluent capacity of the treatment pond in adopting the CP Technology.

Model 2b: $C_{/BOD=}$ F (Capacity) ^{CP}

CP= Clean Production Technology

However, it has also been found that when the cost of the treatment plant goes higher, the capacity of effluent becomes lower and the lowest with the implementation of the EMS (Table 4).

Table 4: Cost of treatment effluent with capacity of treatment pond via Clean Production Technology*

Model 2b	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1943.725	1215.389		1.599	.117
Capacity (m3/day)	-.016	.763	-.003	-.021	.983
Implementation of EMS	-634.136	4495.970	-.022	-.141	.889

* Dependent Variable: Total cost for treatment effluent

Model 2b shows indirect relation among the implementation of EMS and the capacity of effluence with the cast of treatment effluents.

4.2.3 Model 3: The Implementation of the EMS Improved Water Quality Criteria

In this model illustrates the importance of adopting the EMS to enhance the quality of discharged effluent using the CP Technology as compared to the EOP Technology.

Model 3a: $C_{/BOD=} F (COD, TSS, O, G)^{EOP}$

COD= Chemical Oxygen Demand (mg/L)

TSS= Total Suspended Solid (mg/L)

O&G= Oil and Grease (mg/L)

EOP= End-of-Pipe Technology

Beta value in model 3a negatively charged which has an indirect relationship between the treatment effluent cost and each COD and TSS water quality parameter. The water quality criteria go lower, as much as the cost of treatment effluent becomes higher which indicate a direct relation with O&G. Similarly, the criteria of the O&G also go higher as much the cost goes higher, with the implementation of the EMS (Table 5).

Table 5 Cost of treatment effluent with water quality criteria via EOP Technology

Model 3a	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	18229.734	6002.812		3.037	.004
COD (mg/L)	-1.241	1.709	-.119	-.726	.472
TSS (mg/L)	-8.102	8.481	-.150	-.955	.345
O&G (mg/L)	2.226	540.590	.001	.004	.997

* Dependent Variable: Total cost for treatment effluent

On the other hand, using the CP Technology was found to improve the criteria for water quality distinctly, particularly when firms implemented the EMS.

Model 3b: $C_{/BOD} = F$ (COD, TSS, O, G, EMS) ^{CP}

This model shows an indirect relationship between the cost of treatment effluent and each of the water quality criteria as well as the implementation of the EMS. As much as the cost goes down, the criterion of the water quality also remains high with the implementation of the EMS (Table 6).

Table 6: The treatment effluent cost with water quality criteria via CP Technology

Model 3b	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2733.706	1517.171		1.802	.079
COD (mg/L)	-.122	.432	-.047	-.282	.779
TSS (mg/L)	-1.184	2.143	-.088	-.552	.584
O&G (mg/L)	-72.664	136.631	-.088	-.532	.598
Implementation of EMS	-1042.817	4581.423	-.036	-.228	.821

a. Dependent Variable: Total Cost of Treatment Effluent

4.2.4 Model 4: The Implementation of EMS Raises Cost Saving

The implementation of the EMS can raise the economic benefits and cost saving of the companies.

Model 4: Cost Saving = F (EMS)

The model shows the benefits of implementing the EMS; wherever the company applied the EMS, it gained economic benefits as cost saving advantages (Table 7).

Table 7: The Benefits of Implementing the EMS based to cost saving

Model 4	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	44577.390	15323.256		2.909	.006
Implementation of EMS	40483.276	58683.602	.106	.690	.494

*Dependent Variable: Total Cost Saving

Model 4 simply shows a direct relation between the implementation of EMS which and total cost saving, thus as much as the company developed their environmental protection practices as much as they will gain an economical benefits.

4.2.5 Model 5: The more merging among Environmental Management Practices, the more sanitary life quality

This model explains the ability of enhancing life quality as well as the economic and the environment through urging the industries towards applying integrated environmental management practices.

Cost Saving = F (EMS, Housekeeping Practices)

It's also assures that merging between advanced management practices can increase cost saving capital as well as environmental protection and natural resource conservation (Table 8).

Table 8: The influence of the EMS and Housekeeping Practices on Cost Saving

Model 5	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	43142.862	18436.020		2.340	.024
Implementation of EMS	41917.805	60211.788	.110	.696	.490
Apply Housekeeping management	4901.305	34077.558	.023	.144	.886

*Dependent Variable: Total Cost Saving

Model 4 indicate the direct relation between both the implementation of EMS and applying housekeeping management and the total cost saving.

4.3 Summary

In general, we can conclude that only 3 out of the 45 surveyed firms have specific environmental section, so the pollution abatement facilities among the surveyed firms are considered as conventional facilities. Firms aware about environmental protection issues and their capital expenditure and operation expenditure/2006 are vary in term of pollution abatement and the type of pollution abatement technology, but only 7% of the surveyed firms achieved 30-40% cost benefits in their total operation cost in 2006 according to their environmental technology type they used.

Cleaner Production Technology (CP) shoes more efficiency in terms of saving operational expenditure while End-of-Pipe Technology is more inexpensive in term

of operational cost but still not as much as CP efficiency. In another hand only 14 firms applied Housekeeping Management Process as a kind of environmental friendly practices.

According to the Malaysian Department of Environment (DOE) standard, Water quality classification and index range for Kamunting Industrial Zone is polluted.

Environmental Management Standard such as Environmental Management System and ISO Standard can help firms come over complains as well as address several benefits in the economic and biologic side of view.

CHAPTER 5

GENERAL DISCUSSION

5 Introduction

In this section, several points including pollution activity and abatement facilities and the bio-economic models will be discussed intensively.

5.1 Pollution Activity and Abatement

5.1.1 Pollution activities

The study indicate that there are four major types of pollution in the area, which are air pollution, effluents, solid waste, and toxic waste. It also indicate that Only 11% of the total waste generation has been recycled and reused, while 89% was emitted, discharged, or disposed off after simple treatments to the nature (Figure 11). The question now is why there wasn't that much treatment has been using to abatement these pollutants?

From the total industrial pollution, air emission was placed at 21%, effluent (42%), solid waste (32%), and only 5% for toxic waste. However, pollution abatement facilities, among the surveyed firms, were indicated as conventional facilities. This is mainly because of the air filtration that used to treat pollution emission; in some cases. In terms of effluent, 10% of it was recycled and reused in the process. Meanwhile, effluent is traditionally and directly discharged to the environment after being treated in the Effluent Treatment Plant (ETP) to meet the standard of the state

effluent discharge. Toxic waste is directly sent to Kualiti Alam for specific disposal (Figure 11).

5.1.2 Pollution abatement facilities

The capital expenditure for all the pollutant treatment is higher than the operation expenditure, especially in firms that adopt CP Technology in their strategy (Figures 13 & 14). This is mainly because of the high cost of these technologies. Consequently, the capital expenditure for the treatment of air emission incurs more cost than the operational expenditure by RM 84,630, while the capital expenditure for the treatment of toxic waste is higher than the operational expenditure by RM8, 325. Moreover, the capital expenditure for the treatment of solid waste is higher than the operational expenditure for about RM 29, 429; the capital expenditure for the treatment of effluent is more than the operational expenditure by RM 55, 260.

However, the CP technology is more efficient in terms of saving operational expenditure as compared to the EOP Technology. Although using the EOP technology is cheaper than the CP Technology in terms of their operational cost, it does not impose any abroad impact on pollution abatement effects because it is a simple technology.

The results also detected the amount of Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), and Oil and Grease (O&G) as indicators for water pollution. BOD is an indicator of organic pollutant which is applied to both wastewater and surface water. And it used to determine the amount of dissolved oxygen in the water and effluent. COD is also used to determine oxygen requirements to oxidize the organic matter, using a strong oxidizing agent in an acidic medium. TSS indicates the

amount of dry-weight particles in water and effluent. Oil and grease includes vegetable and natural oils, sediments, biota, and decaying life forms are often high in natural oil lipids, which make up parts of the oil and grease measure. These pollutants affect the cost of treatment effluent. As a result, firms use water quality parameter as adequate pollution treatment.

The mean amount of water pollutants based on the CP Firms is quite low (Figure 19) As a consequence, water quality released is considered under Standard A of the Malaysian Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979. In addition, it is also considered as Class IV of the Malaysian (DOE) Water Quality Index Classification. On the other hand, the mean amount of pollutant, released from EOP firms, was found to be much higher than the Cleaner Production one (Figure 19). Thus, it can be concluded that these firms are located above Standard B, according to the Malaysian Environmental Quality (Sewage and Industrial Effluents) Regulations (1979), as well as under Class V of the Malaysian (DOE) Water Quality Index Classification, see Appendix 3.

5.2 Bio-Economic Models

5.2.1 Model 1: The Implementation of the EMS Affecting the Cost of Treatment Effluent

The implementation of the EMS among the firms can help reducing the cost of treatment effluent. Watson *et al*. (2004) agree with this finding, they indicated in their study that the implementation of EMS strategy did not only affect the cost of the treatment effluent, but also the overall financial performance of the firms. On the other hand, a common study conducted by the local government and industrial

agencies in Bartow Country (Toon, 2005) showed that the implementation of the EMS in the country's industries has been proven to improve its quality of life and financial climate. In particular, it has bottom-line impacts for both industry and government, i.e. reducing its operation costs by cutting the energy consumption, producing less solid waste, reducing water usage and improving maintenance of the transportation systems.

5.2.2 Model 2: Implementation of the EMS Affecting the Capacity of the Pond Treatment

The capacity of effluent is dependent on the type of technology used by the firms and thus effluence the cost for treatment. The direct relationship between the costs of treatment effluent to control BOD and the effluent capacity of the treatment pond is not efficient comparing to CP technology.

The relationship between the effluent capacity of the treatment pond; the cost of the waste treatment has an indirect relationship in the Integrated Environmental Management Technologies (Such as Cleaner Protection Technology) was used, as compared to using the Traditional Environmental Management Technologies (such as End-of-Pipe Technology). When the cost for the treatment effluent is high, the efficiency of the technology is reduced, and the implementation of the EMS was found. This finding is supported by Skerman (2004) who found that the implementation of well-designed, continuous and manageable application systems, in treating pond effluent, became more desirable and generally better in protecting the environment, reducing the effluent capacity and making an effective use of the nutrient and water value of the effluent. In addition, Husseini (2005) showed several

case studies on the benefits of implementing the EMS in his study. For example, the implementation of ISO 14001 into Ford's Lima Engine Plant in Ohio, USA, came up with 200000 m^3/day of effluent consumption. The president of that company underlines that "by implementing ISO 14001 preserving the environment is a competitive advantage and a major business opportunity." Moreover, promoting ISO 14001 into Suzhou Industrial Park (SIP) in the city of Suzhou, China, was found to reduce wastewater capacity and save around USD 1.8 million per year (Husseini, 2005).

5.2.3 Model 3: The Implementation of the EMS Improved Water Quality Criteria

Water quality is a very sensitive criterion affecting all types of aquatic life. Thus, it is important to control the pollutant discharged from the industrial sectors to insure the performance of the aquatic life. Water quality efficiency in CP adoption firms go higher, as much as the cost of treatment effluent becomes lower in contrast to EOP technology. On the other hand, using the CP Technology improve the criteria for water quality particularly when firms implemented the EMS. The comparison between the two parts of Model 3 shows indirect relationships between the cost of treatment effluent and both water quality criteria and implementation of the EMS. As much as the cost goes down, the criterion of the water quality also remains high with the implementation of the EMS.

The analysis revealed that the increase in the implementation of EMS had a positive effect on the quality of discharged effluent. It has also been shown to reduce the cost of treatment effluent. Kricun and Pedersen (2007) agree with this finding; they

believe that the implementation of the EMS into Camden County Municipal Utilities Authority, New Jersey, could improve the effluent quality by 40-50% (22ppm TSS in 1999 to 10ppm in 2007, 25ppm BOD in 1999 to 15ppm in 2007), as well as increase the removal of the TSS and BOD (TSS: 88% in 1999 to 95% in 2007, BOD & COD: 85% in 1999 to 95% in 2007). In another case study, Pulp and Paper Mills (India) modified their process and equipment to suit the CP Technology, and this was found to help the company to reduce its wastewater amount and save USD 93000 (Husseini, 2005).

5.2.4 Model 4: The Implementation of EMS Raises Cost Saving

In all business economic, the benefits and cost saving are the only concerns. The benefits of implementing the EMS in applied company, is to gain economic benefits as cost saving advantages. Several case studies show cost saving benefits from the implementation of the EMS. In Fort Lewis (the largest active military facility in Washington State-USA) challenges had been realized after the installation of the EMS facilities. The study showed numerous efforts which include cost savings and avoidance of more than $1.0 million. In particular, Ft. Lewis was found to reduce green house gases by 155,510 pounds (78 tons). The installation had already achieved a 70% reduction in hazardous waste; a 68% reduction in hazardous material usage; a 60% reduction in the purchase and use of Class I ODC chemicals; a $5.0 million saving of energy performance and a 50% reduction in natural gas usage.

In another case study, developing and implementing the EMS at the Steel Production Flow of Sidex Galati, Romania, the maintenance of equipment was improved after an evaluation of lubricant losses. As a result, oil and grease losses were reduced by

10% and 650 litres of oil were monthly recovered which saved an annual cost of $3,000. Moreover, in the IBM Company, USA, energy conservation initiatives are implemented, and these include refined manufacturing processes, and updated HVAC systems, lighting, etc., and this was found to save USD 15.1 million in 1995 and reduce electricity use by 226 million kilowatt hours (Husseini, 2005).

5.2.5 Model 5: The more merging among Environmental Management Practices, the more sanitary life quality

Nowadays, all scientists are concerned with how to raise the quality, and at the same time put it in balance, both with the economic and environmental needs.

This finding is paralleled to the one by Kerekes *et al*. (2000). According to their study on Environmental Policy Tools and Firm-level Management Practices in Hungary, they believe that Environmental performance correlates significantly with the implementation of the EMS, and this supports the expectation which states that introducing the EMS can improve corporate environmental performance. In general, environmental actions and investments exhibit a strong relationship with environmental management across industries, but it also shows sector-specific characteristics. Meanwhile, Azorín *et al*. (2008) indicate that Spanish hotels have stronger commitment towards environmental practices to reach higher performance levels. Moreover, the regression analysis of their study showed that environmental practices had a significant impact on several performance variables. On the other hand, Mudalige *et al*. (2007), claimed that farms, near to urbanization in Canada, are most likely to implement Environmental Friendly Practices to overcome social and regulatory pressures, as compared to the farmers who are operating in the rural

communities. These farms faced a significant systematic control as well as economic and environmental performance.

5.3 Summary

The implementation of the EMS, in any firm or company, could decrease the cost of treatment pond through the improvement of process technology and equipment.

The increase of the implementation of the EMS could reduce the effluents and enhance the quality of water. Therefore, the combination of the EMS with other Environmental Protection practices provides economic as well as biological advantages and its effectively strengthen the company's competitiveness in business.

.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

---

6 Introduction

In this chapter, a brief overview of the whole study is presented; this includes introduction, literature review, methodology, findings, and discussion to illustrate a complete picture of the real environmental situation in Kamunting Industrial Zone. At the same time, some recommendations and suggestions for future studies are also given in this chapter.

6.1 Overall Conclusion

The objectives of this research focused on the effects or impacts of implementing Environmental Management System on the performance of the firm, including environmental and economical impacts, through the identification of the types of both environmental control and management strategies among industries, comparing between management techniques/strategies used by the different firms to prevent pollution, identification of cost-benefits measures, identification and analysis of barriers in implementing EMS, and identification of the typical option to improve resource conservation and management. All these have been elaborated in Chapter 1.

The research was first undertaken by conducting a literature review from the previous studies, emphasizing on the benefits of implementing EMS, the reasons for

adapting advanced environmental practices, and the economic view of environmental valuation. The literature review shows a connection between EMS implementation and economic advantages among the firms, there has been a wide awareness towards the benefits of EMS and how to ensure its successful implementation.

Technically, the surveyed firms in Kamunting Industrial Zone indicated their preference to mainly implement End-of-Pipe Techniques (63%), as compared to cleaner Protection Techniques, partly because the earlier are easier to install and are lower in price, while the rest of the firms (38%) were introduced to the benefits of implementing the EMS.

Firms which have adopted the EMS are experts in a wide range of benefits. Besides, many researchers have been carried out on studying the benefits of the EMS, particularly for economic advantages, but no research has so far related these benefits as an economic models. However, the bio-economic models in this study statistically showed the ability of the EMS to decrease the cost of the treatment effluent, decrease the capacity of the treatment effluent, enhance the quality of water, and cost saving advantage. This method shows that environmental performance comes together with the economical performance of a particular firm. This also means that the company intends to enhance their environmental issues just as much as it wants to gain economic advantages. In particular, this method helps to open new opportunities for science-environment-economic views.

6.2 Specific Findings

One of the research specific findings is the capability of the Cleaner Production Technology, specifically the EMS, to control water pollutant and improve water

quality. Significantly, the results presented in Chapter 4 revealed a big difference between water quality readings, based on End-of-Pipe Technology and Cleaner Production Technology; each technology have different levels of water quality criteria, according to the levels and classification of water quality outlined by the Department of Environment (DOE), Malaysia. From the economic perspective, the analyses showed an indirect relationship between the cost of the treatment effluent and the effluent quality criteria in the present of the EMS. Whenever the quality of effluent is improved, the cost is still down especially when firms are implementing the EMS.

In a study conducted at the University of Nebraska–Lincoln Risse *et al*. (2005) claimed that in using the EMS to improve compliance on livestock and poultry operations, the implementation of the EMS has been shown to help companies to demonstrate their environmental performance, compliance with the regulations and whether or not they meet the needs of the watershed managers and agency for a consistent framework, through which producers accept their responsibility and behave proactively in reducing non-point pollution threats. Thus, to meet the insurers' and bankers' needs for reduced environmental liability. A key finding of their project is that the Environmental Management Systems are a more comprehensive approach which encourages the producer to take ownership of the issue and work on improving the company to move beyond the compliance, which also provides significant economic advantages. On the other hand, Coomes (2008) indicated that the implementation of the EMS, in the city of Dallas in 2005, has made significant improvements to sustainability, environmental compliance, operating procedures, and environmental awareness including recycling, waste management,

water quality, water conservation, air quality, energy consumption, and green building. These significant benefits enable Dallas, in conjunction with other public and private organizations, to form a regional EMS initiative to learn more about it.

Finally, some recommendations are proposed, and findings gathered from the research are incorporated. The recommended actions could be undertaken in order to encourage more companies to gain the benefits of the EMS and increase its implementation, as well as obtain sustainability and conservation for a better quality of life. It can be concluded that Kamunting Industrial Zone still needs to place more concern over putting the EMS in its consideration within its technical advancement so as to achieve the challenge of the integrated environmental and economical performances.

6.3 Recommendations

In particular, environmental sustainability need more forward-looking and corporations to achieve global sustainability goal. The increasing in current environmental management awareness, including the implementation of EMS and its benefits, enhance the usage of environmental standards such as ISO standard.

Provide effective communication pathways through Environmental Conferences, workshops, and training to cover all the gaps and move the environmental management forward. Also encouraging the government to redesign their environmental policy, and at the same time introduce new fines to encourage companies to commit towards environmental performance as well as create corporation between the Government and the Private sectors to promote the more environmental friendly practices through credits and awards. And also establish a

volunteer program for industrial sectors can provide the latest updates on environmental management practices and their significant advantages.

6.3.1 The Significance of Environment and Technology

It has been demonstrated that the concepts and tools of the EMS are important to our perspective of industry and its relationship to the environment. Perhaps, it is a symbolic appreciation of both nature and industry as interconnected systems; the systems which ideally act to conserve and reuse resources, to be resilient under stress, and evolve in response to needs. The EMS includes such highly focused topics as detailed product design and methods for choosing materials, but at heart, it is a systematic control management.

6.3.2 The Status of the Resources

An important advantage to sustainable development which is frequently mentioned is the pending shortages of some of the resources, on which the technological society is dependent upon. Observing these concerns, corporations seeking to improve their environmental performance typically list resources conservation as an item for attention, and resource use is a commonly included component in sets of environmental performance metrics. Clearly, there is an impression that the availability of resources is a legitimate. Thus, the EMS and other environmental management practices concern with the natural resources as their first priority and believe that the more sustainability and conservation gains, the more economic benefits will be.

6.3.3 Society and Culture

The relationship between social and economic system, EMS and environmental system is not static. Each co-evolves with the others, changing its natural dynamics and the overall system state as it does so. These interactions occur at three levels. The first and broadest perspective treats the EMS as a part of the overall scientific and technological enterprise. At this scale, the EMS is, like any human activity, heavily dependent on the current historical, social and cultural contexts. For example, the EMS as an important response to environmental perturbations could not have developed until after early 1970s, with its explosion of the environmental activism. The abroad level of the EMS is the purview of sociologists and historians, and not the EMS itself.

Similarly, most EMS will not be directly involved in the second level of societal interaction, where it is viewed as a case study from the perspective of the sociology of science. The third level includes the "practice" of the EMS. In this aspect, both the cultural and social dimensions are treated as objective elements of an EMS study. For example, any EMS study of chemical industry would need to take notice of the changes in demand and demographics which would lead to a lesser significant impact to the environment as well as lower price selling.

6.3.4 The Governments, Laws, and Economics

Governments, especially as they act through the development and implementation of legal and policy systems, can play important roles in the implementation of environmentally responsible technology. The discipline of economics and its metrics are perhaps the most powerful generic underpinnings of these systems. Accordingly,

it is important for environmental management practices to have a working knowledge of applicable aspects of the governments, laws, and economics.

Building disciplinary and strategic research bridges across environmental management practices and innovation studies have much to commend it. Many theoretical and empirical avenues have been opened up by allowing the two research fields to interact and there may also be opportunities for contributing to policy depots.

6.4 Suggestions for Future Research

The present research addresses additional issues for future research. For more insights into this study, future research can include longer period of study with the extension of the evaluation on the effectiveness of the findings (the effluence of EMS on water quality and capacity of treatment effluent to Air quality and emissions control, if possible). In addition, the resources should involve a larger scope of study, such as comparing the benefits of the EMS with other industrial zone, both inside or outside the country.

In addition, any future research should widen the scope of the study to other sectors, not only the industries, but also agriculture, architecture, or the society. Hopefully, the present research will provide a beginning to creative studies which combine both environmental science and economics to address the benefits of the EMS. These findings offer practical information to the managers and to support previously untested propositions, thus laying the ground work for additional research.

Therefore, it is advisable and easy for the management to carry out many EMS programs and combine other environmental friendly practices in order to advance in

both the environmental and economical performances; this only shows that the management needs to only identify the right ways to address the progress. Finally, based on the results of the survey, the researcher believes that the adoption or the practice of EMS is a very worthwhile effort which rewards companies with tangible organizational improvement. Hence, based on the fruitful findings, it is proposed that the Malaysian industries increase adopting of the EMS elements in their organizations to achieve Vision 2020.

References

Agenda 21, UN Department of Economic and Social Affairs, Division for Sustainable Development. Available at: http://www.un.org/esa/sustdev/documents/agenda21/index.htm

Andrews, R.N.L., Darnall, N., Gallagher, D.R., Keiner, S.T., Feldman, E., Mitchell, M.L., Amaral, D. and Jocoby, J.D. 2001, "Environmental Management System: History, Theory, and Implementation Research", pp: 31-60. In Cogianese, C. and Nash, J. (eds), "Regulation from the inside: Can environmental management system achieve policy gaols?" RFF Press, USA.

Arveson, P. 1998, "The Deming Cycle", Available at: http://www.balancedscorecard.org/TheDemingCycle/tabid/112/Default.aspx

Ashford, N.A. 1993, "Understanding technological responses of industrial firms to environmental problems: Implication for government policy", In K. Fischer & J. Schot. (Eds.), Environmental strategies for industry: International perspectives on research needs and policy implications: 277-307. Washington, D.C.: Island Press.

Azorín, J.F.M., Enrique, C.C., Jorge, P.M. and Tarí, J.J. 2008, "Environmental practices and firm performance: an empirical analysis in the Spanish hotel industry", *Journal of Cleaner Production*, available at: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VFX-4TRHC2F-2&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=1d176eabb6d5714d4ebfb771718f8ee0

Babakri, K.A., Bennett, R.A., and Franchetti, M., 2003, "Critical factors for implementing ISO 14001 in United States industrial companies", *Journal of Cleaner Production*, (11): 74952.

Baxter, M. 2007, "ISO 14000 Series Standards", *IEMA Annual Conference*. Transforming Strategies, TRST.com, available at: http://www.trst.com/

Boiral, O. 2001, "ISO 14001 Certification in Multinational Firms: The Paradoxes of Integration1".

Bradshaw, L. Victoria 2008, "Clean Technology and the Green Economy", California Economic Strategy Panel, available at: http://www.labor.ca.gov/panel/pdf/DRAFT_Green_Economy_031708.pdf

British Standard Institution (BS 7750), available at: http://www.standardsuk.com/?gclid=CJionIjI05cCFU0upAod2HuVDA

Cairncross, F. 1992, “Costing the earth”. Harvard Business School Press.

Camino, R. J. 2001, “What Motivates European Firms to Adopt Environmental Management System?”. *Eco-Management and Auditing*, 8(3), 134-143.Chan, K.Y. and Li, X.D. 2001, “A Study of the Implementation of ISO 14001 Environmental Management Systems in Hong Kong”, Journal *of Environmental Planning and Management*, 44(5): 589-601.

Christmann, P. 2000, “Effects of “Best Practices” of Environmental Management on Cost Advantage: The Role of Complementary Assets”, *Academy of Management Journal*, 43(4): 663-680.

Clark, W.W., Paolucci, E. and Cooper, J. 2003, “Commercial development of energy—environmentally sound technologies for the auto-industry: the case of fuel cells”, *Journal of Cleaner Production*, 11: 427–437.

Clements, R.B. 1996, “Complete guide to ISO 14000. Englewood Cliffs”, *NJ: Prentice Hall*.

Cogianese, C. and Nash, J. (eds), “Regulation from the inside: Can environmental management system achieve policy gaols?”, *RFF Press*, USA.

Coomes, G. 2008, “Enhancing Performance through Environmental Management Systems and Regional Initiatives”, *southwest network for zero waste*, available at: http://www.zerowastenetwork.org/blog/2008/06/enhancing-performance-through.html

Corning, P.A. 1996, “Bioeconomics as a Subversive Science From 'Tastes' and 'Preferences' to 'Adaptation' and 'Basic Needs”**,** *Western Economics Association International*, San Francisco, CA.

Culley, W.C., 1998, “Environmental and quality systems integration”. *Washington: Lewis Publisher*. 328 pp.

Curkovic, S., Sroufe, R. and Melnyk, S. 2005, “Identifying the factors which affect the decision to attain ISO 14000”, *Energy Journal*, 1387–1407, available at: www.elsevier.com/locate/energy

Darnall, N., Gallagher, D.R., Andrews, R.N.L., Amaral, D. (2000), "Environmental management system opportunities for improved environmental and business strategy", *Quality Progress*, 9(3): 1-9.

Delmas, M. and Marcus, A. 2004, “Firms’ choice of Regulatory Instruments to Reduce Pollution: a Transaction cost approach, Journal of Business and Politics: 6(3), Article 3.

Delmas, M. 2002, “The Diffusion of Environmental Management Standards in Europe and in the United States: an institution al perspective”, *Journal of Policy Science*. 35(1): 1-119.

Douglas, R.B. 2000, “A study of A Review of Bio-Economic Models”, thesis for *Cornell University*. Eco-Management and Audit Scheme (EMAS), available at: http://www.iema.net/ems/emas

Environmental Management System at an Iron and Steel Plant, Project for Steel Production Flow of Sidex Galati, 2000, available at: http://www.rec.org/ecolinks/bestpractices/PDF/romania_iron.pdf

EPA United State Environmental Protection Agency, available at: http://www.epa.gov/

Epstain, M.J., and Roy, M.J., 1997, “Using ISO 14001 for improved organizations learning and environmental management”, *Environmental Quality Management*, 7(1):2130.

EUROPA, website on EMAS, available at: http://europa.eu.int/index_en.htm

EUROPA, website on Eco-Management and Audit, available at: http://ec.europa.eu/environment/emas/index_en.htm

Florida, R. 1996, “Lean and green: The move to environmentally conscious manufacturing”. *California Management Review*, 39(1): 80-105.

Fort Lewis, part of Forces Command (FORSCOM), “Culture Change and Environmental Leadership at Ft. Lewis Washington”, available at: http://205.153.241.230/ems/success/ftlewis_final.html

Garlauskas, A.B. 1995, “Conceptual framework of Environment Management, *Journal of Environmental Management*, 3(3): 185-203.

Garner, A., and Keoleian, G.A., 1995, “Industrial Ecology: An Introduction”, *National Pollution Prevention Center* for Higher Education, University of Michigan School of Natural Resources and Environment, and NPPC Research Manager, pp2.

Global Environment & Technology Foundation, 2006, “EMS-Financial Case Studies in the Public Water Sector”, Charleston Water, Charleston South California, available at: http://www.peercenter.net/ewebeditpro/items/O73F8647.pdf

Hamschmidt, J. and Dyllick, T. 2001, “ISO 14001: Profitable? Yes! But it is eco-effective?”, *Greener Management International*, 43-54pp.

Hart, S.L. 1995, “A natural-resource based view of the firm”. *Academy of Management Review*, 20(4):986-1014. In D. Collins & M. Starik (Eds.), Research in corporate social performance and policy supplement, 1: 43-66. Greenwich, CT: JAI Press.

Hettige, hammalaH.l.A., Huq, M., Parhal, S. and wheeler, D. 1996, “Determinants of Pollution Abatement in Developing Countries: Evidence

from South and Southeast Asia", *The World Bank, Washington DC, U.S.A. World Development*. 24,(12): 1891-1904.

Hillary, R. 1999. Evaluation of study reports on the barriers, opportunities and drivers for small and medium sized enterprises in the adoption of environmental management systems. Network for Environmental Management and Auditing, available at: http://inem.org/htdocs/iso/hillary.html

Hillary, R., 2004, "Environmental management systems and the smaller enterprise", Journal of Cleaner Production, 12:5619.

Hilson, G. and Murck, B. 2001, "Progress toward pollution prevention and waste minimization in the North American gold mining industry", *Journal of Cleaner Production* 9: 405–415.

Holden, J., Evans, M. G., Burt, T. P. and Horton, M. 2006, "Impact of Land Drainage on Peatland Hydrology", *J Environ Qual* 35:1764-1778. Available at: http://jeq.scijournals.org/cgi/content/full/35/5/1764

Hui, I.K., Chan, A.H.S., and Pun, K.F., 2001 "A study of the environmental management system implementation practices", *Journal of Cleaner Production*; 9:26976.

Husseini, A. 2005, "ISO Management Systems: What will an EMS do for my organization? Some concrete answers", *ISO publication*, Special Report Business benefits. Volume 12, No 1, available at: http://www.standards.org.sg/files/vol12no1art1.htm

International Organization of Standardization (ISO), publication, website: ISO Guideline: http://www.iso.org/iso/publications_and_e-products.htm, ISO TC207: http://www.tc207.org/, and ISO: http://www.iso.org/iso/iso_catalogue/management_standards/benefits.htm

Jung, C., Krutilla, I. and Boyd, R. 1996, "Incentives for Advanced Pollution Abatement Technology at the Industry Level: An Evaluation of Policy Alternatives", *Journal of Environmental Economics and Management*, 30(95),111.

Kerekes, S., Harangozó, G., Németh, P. and Zsóka, Á.N. 2000, "Environmental Policy Tools and Firm-level Management Practices in Hungary", *OECD Environment Directorate*, available at: http://www.oecd.org/dataoecd/26/0/31686250.pdf

Kricun, A. and Pedersen, T. 2007, "Using Environmental Management Systems to Lower Operating Costs and Improve Environmental Performance", *Water Environment Federation*, WEFTEC 2006: Session 31 through Session 40(15): 2429-2443, available at: http://dx.doi.org/10.2175/193864706783750673

Korhonen, J., 2004, “A study of Industrial ecology in the strategic sustainable development model: strategic applications of industrial ecology”, Journal of Cleaner Production, 809–823pp.

Lifset, R.J. and Graedel R.E. 2002, “Industrial Ecology: Goals and definitions, in A Handbook of Industrial Ecology”, *Edward Elgar Publishers*, 3-15.

Lin, C.M. 1995, “The significance of ISO 14000 environmental standards for Asia Pacific”, *APO Productivity Journal*, 4:6582.

Lookman, A.A. and Rubin, E.S. 1998, “barriers to adopting least-cost particulate control strategies for Indian power plants”, Department of engineering and public policy, Center of Energy and Environmental Studies, Carnegie Mellon University, Pittsburgh, PA 15213, USA, 26(14): 1053-1063.

MacNeill, J.W. 1971, “Environmental Management”, Canada, Ottawa Information Center.

Melnyk, S.A., Sroufe, R.P. and Calantone, R. 2003, “Assessing the impact of environmental management systems on corporate and environmental performance”, *Journal of Operations Management*, 21: 329–351.

Miles, M.P, Munilla, L.S., and McClurg, T., 1999, “The impact of ISO 14000 environmental management standards on small and medium sized enterprises”, *Journal of Quality Management*, 4(1):11122.

Mitsuhashi, T. 1998, “ISO 14001 and the role of top management”, *APO News*; 12.

Mohammed, M. 2000, “The ISO 4001 EMS Implementation Process and Its Implication: A Case Study of Central Japan”, *Environmental Management*, 25(2): 177-188.

Mudalige, U.J., Weersink, A., Deaton, B.J. and Trant, M. 2007, “Effect of urbanization on the adoption of environmental management systems in Canadian agriculture”, *International Journal of Agricultural Resources, Governance and Ecology*, 6: 316-325, available at: http://inderscience.metapress.com/app/home/contribution.asp?referrer=parent&backto=issue,2,8;journal,6,22;linkingpublicationresults,1:110835,1

Petak, W.J. 1981, “Environmental Management: A System Approach”, *Journal of Environmental Management*, 5(3): 213-224.

Petroni, A. 2001, “Developing a methodology for analysis of benefits and shortcomings of ISO 14001 registration: lessons from experience of a large machinery manufacturer”, *Journal of Cleaner Production*, 9:35164.

Porter, M. and Claas, V.D.L 1995, “Green and Competitive: Ending the Stalemate”, *Harvard Business Review* September-October: 120-134. In Cogianese, C. and Nash, J. (eds), “Regulation from the inside: Can

environmental management system achieve policy gaols?", RFF Press, USA.

Puller, S.L. 2006, "The strategic use of innovation to influence regulatory standards", *Journal of Environmental Economics and Management* , 52: 690–706

Pun, K.F., Hui, I.K., Lau, H.C.W., Law, H.W. and Lewis, W.G. 2002, "Development of an EMS planning framework for environmental management practices", *International Journal of Quality & Reliability Management*, 9(6): 688-709.

Radonji, G. and Tominc, P. 2007, "The role of environmental management system on introduction of new technologies in the metal and chemical/paper/plastics industries", *Journal of Cleaner Production*, 1482e1493

Reinheimer, H. 1913, "Evolution by Co-operation: A Study in Bioeconomics", Springer Netherlands, 7(1): 1-38.

Rennings K., Ziegler A., Ankele K. and Hoffmann E., 2006, "The influence of different characteristics of the EU environmental management and auditing scheme on technical environmental innovations and economic performance", *Journal of Ecological Economics*,57(1): 45-59.

Risse, L.M., Koelsch, R.K., Bland, B., Bird, E.A. and Bass, T.M. 2005, "Using EMS's to Improve Compliance on Livestock and Poultry Operations", *Conference Presentations and White Papers: Biological Systems Engineering*, available at: http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1022&context=biosysengpres

Sambasivan, M. and Fei, N.Y. 2008, "Evaluation of critical success factors of implementation of ISO 14001 using analytic hierarchy process (AHP): a case study from Malaysia", Journal of Cleaner Production, 16: 1424-1433.

Sammalisto, K. and Brorson, T. 2008, "Training and communication in the implementation of environmental management systems (ISO 14001): a case study of University of Ga¨vle, Sweden", *Journal of Cleaner Production*, 299-309.

Sayre, D. 1996, "Inside ISO 14000: the competitive advantage of environmental management", *Delray Beach, FL: St. Lucie Press*.

Seiffert, M.E.B. 2008, "Environmental impact evaluation using a cooperative model for implementing EMS (ISO 14001) in small and medium-sized enterprises", *Journal of Cleaner Production*, 16:1447-1461.

Skerman, A.G. 2004, “Dairy pond - A tool to assist in calculating dairy effluent pond volumes and dimensions”, Department of Primary Industries and Fisheries. Available at: http://www2.dpi.qld.gov.au/environment/13255.html

Stead, W.E., & Stead, J.G. 1995, “An empirical investigation of sustainability strategy implementation in industrial organizations”, In D. Collins & M. Starik (Eds.), Research in corporate social performance and policy, Supplement 1: 43-66. Greenwich, CT: JAI Press.

Steger, U., 2000, “Environmental management systems: empirical evidence and further perspectives”, European Management Journal; 18(1):23-37.

Stock, G.G., Hana, J.L., and Edwards, M.H., 1997, “Implementing an environmental business strategy: a step-by-step guide”, Environmental Quality Management, 6(4):33-41.

Strasser, K.A. 1996, “Preventing pollution”, *Fordham Environmental Law Journal*,8: 1-57. In Cogianese, C. and Nash, J. (eds), “Regulation from the inside: Can environmental management system achieve policy gaols?”, RFF Press, USA.

Sulaiman, M. and Nik Ahmad, N.N. 2002, “Environmental Management System: Perception of ISO 14001 Certified Sites”. *Akauntan Nasional*.

Teck L.G. and Peng L.T. 2001, “ISO 14000: the answer for environmental management implementation: the Malaysian case”, *Journal of Total Quality Management*, 12(2):223-229.

Toon, J. 2005, “Environmental Improvement: Bartow County Industry and Government Work Together in First-of-its-Kind Environmental Management System”, *Economic Development Institute, Georgia Institute of Technology and research*, available at: http://gtresearchnews.gatech.edu/newsrelease/ems.htm

Thomas, C. 2008, “Different position statement on Environmental Management Systems”

Thornton, R. 2000, “ISO 14001 certification mandate reaches automobile industry”, *Journal of Environmental Quality Management*, 10(1):89-93.

Transforming Strategies website, available at: http://www.trst.com/

UNEP website, available at: http://www.unep.org/

USEPA website: http://www.epa.gov/OW-OWM.html/iso14001/

Watson, K., Klingenberg, B., Polito, T. and Geurts T.G. 2004, “Impact of environmental management system implementation on financial performance: A comparison of two corporate strategies”, *Management of Environmental; Quality: International Journal*, 15(6): 622-628.

Welford, R. 1995, “Environmental strategy and sustainable development: the corporate challenge for the 21st century”, Routledge, London.

Welch, E.W., Mori, Y. and Usui A.M. 2002, “Voluntary Adoption of ISO 14001 in Japan: Mechanisms, Stages and Effects”, *Business Strategy and the Environment*, 11: 43-62.

Woodside, G., Aurrichio, P. and Yturri, J. 1998, “ISO 14001 Implementation Manual”, *McGraw-Hill, USA.*

Yahya, S. and Goh, W.K. 2001, “The implementation of an ISO 9000 quality system”, *MCB UP Ltd*, 18(9): 941 – 966.

Zutshi, A. and Sohal, A. 2004, “A study of the environmental management system (EMS) adoption process within Australasian organizations-2. Role of stakeholders, Department of Management, Monish University, Australia.”, *Technovation,* 371–386.

APPENDIX 1

GIS MAPS FOR KAMUNTING INDUSTRIAL ZONE

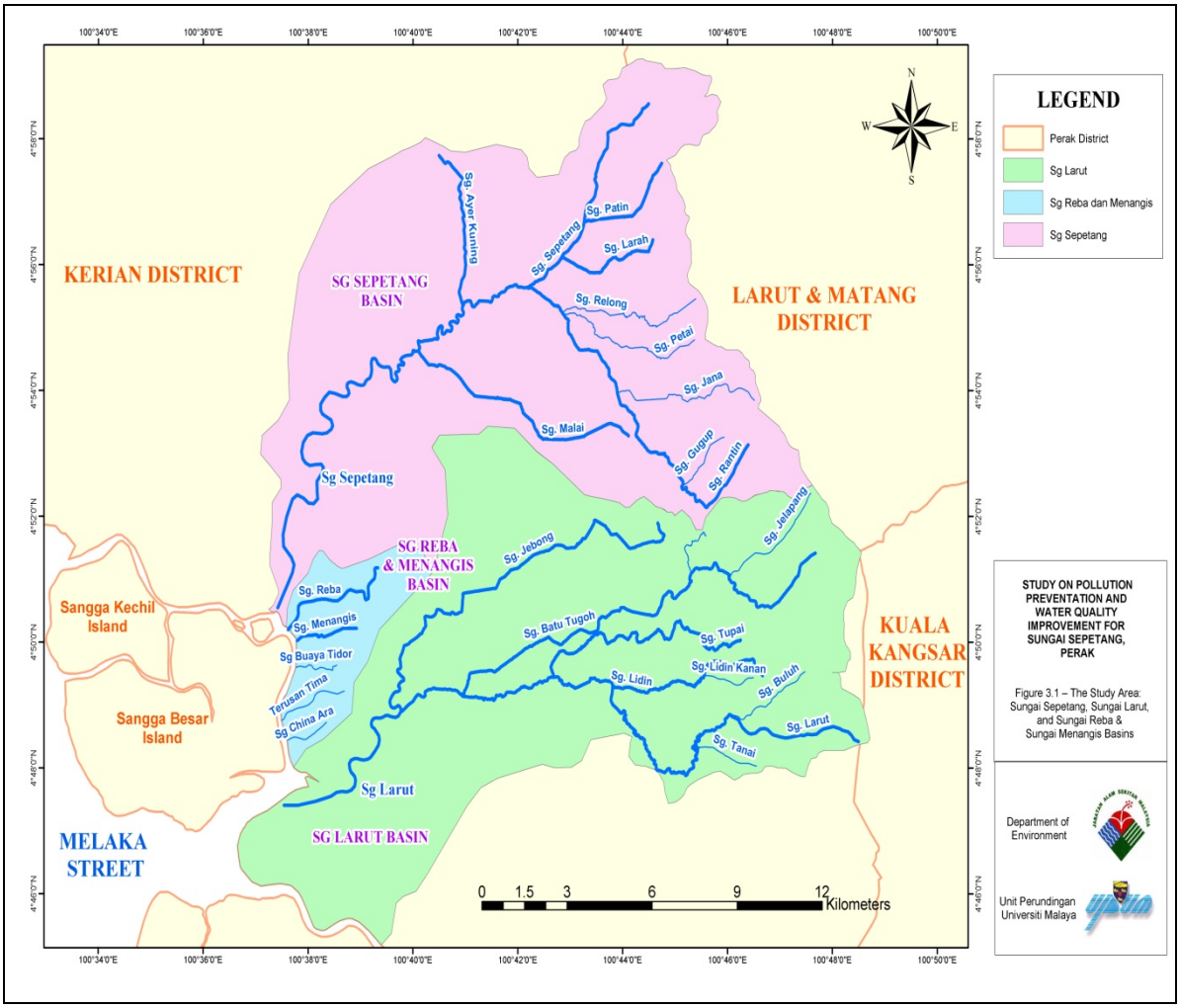

Figure 21: Location of rivers and Sub-basin, Taiping

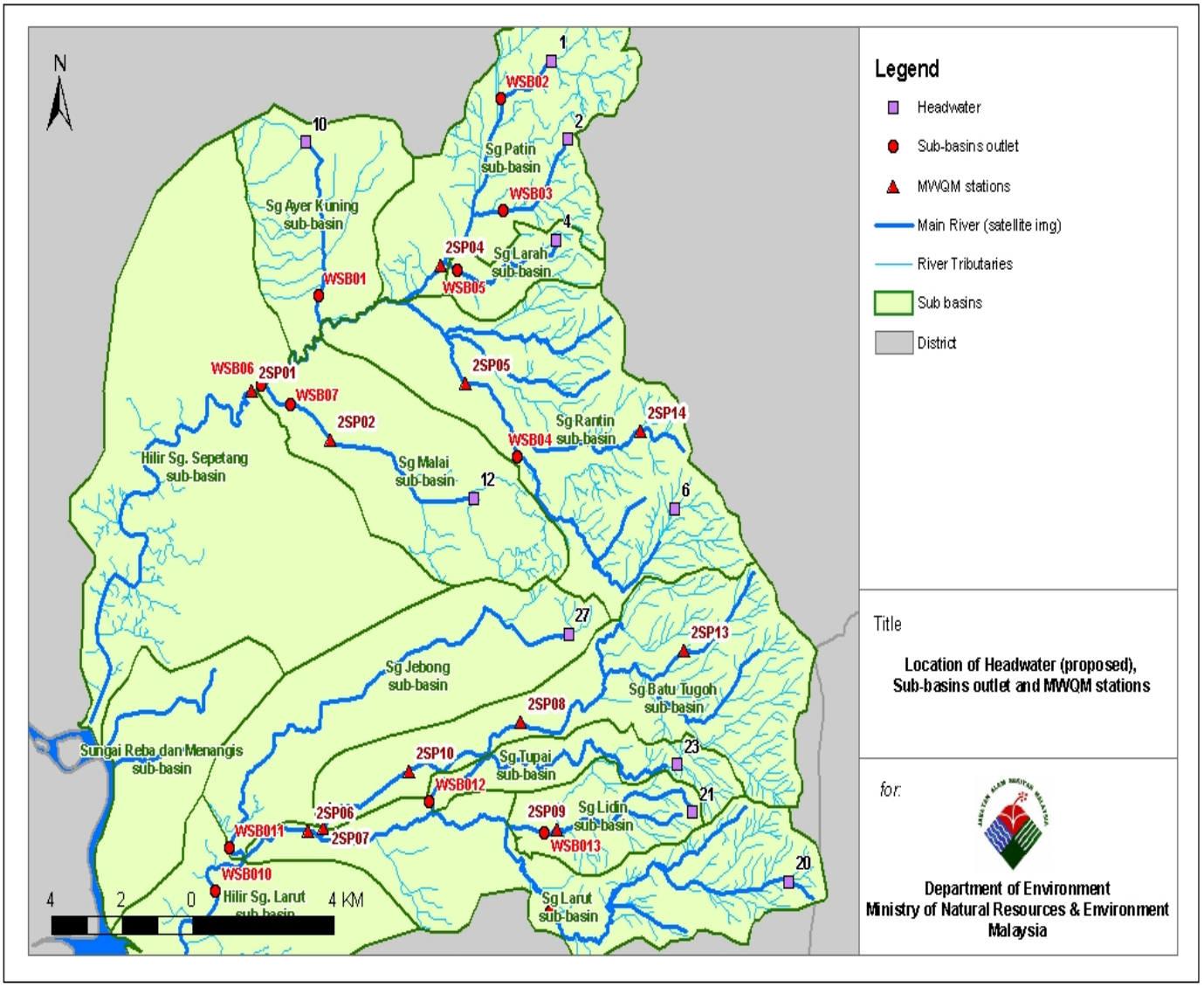

Figure 22: Location of existing DOE, sub-basins (WSB) and headwater (HW) Stations, Taiping

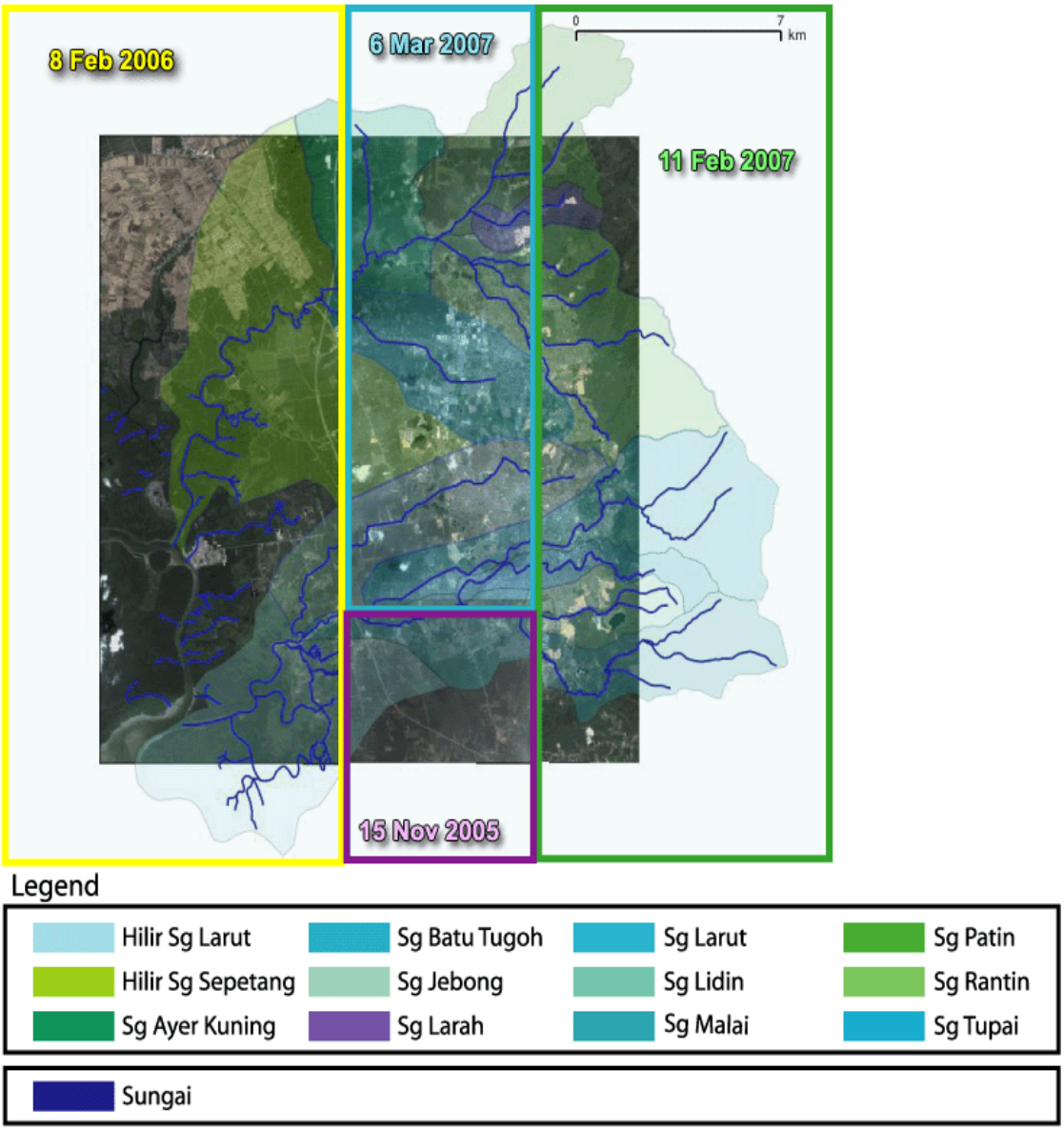

Figure 23: Quick bird Satellite Image coverage and acquisition dates, Taiping

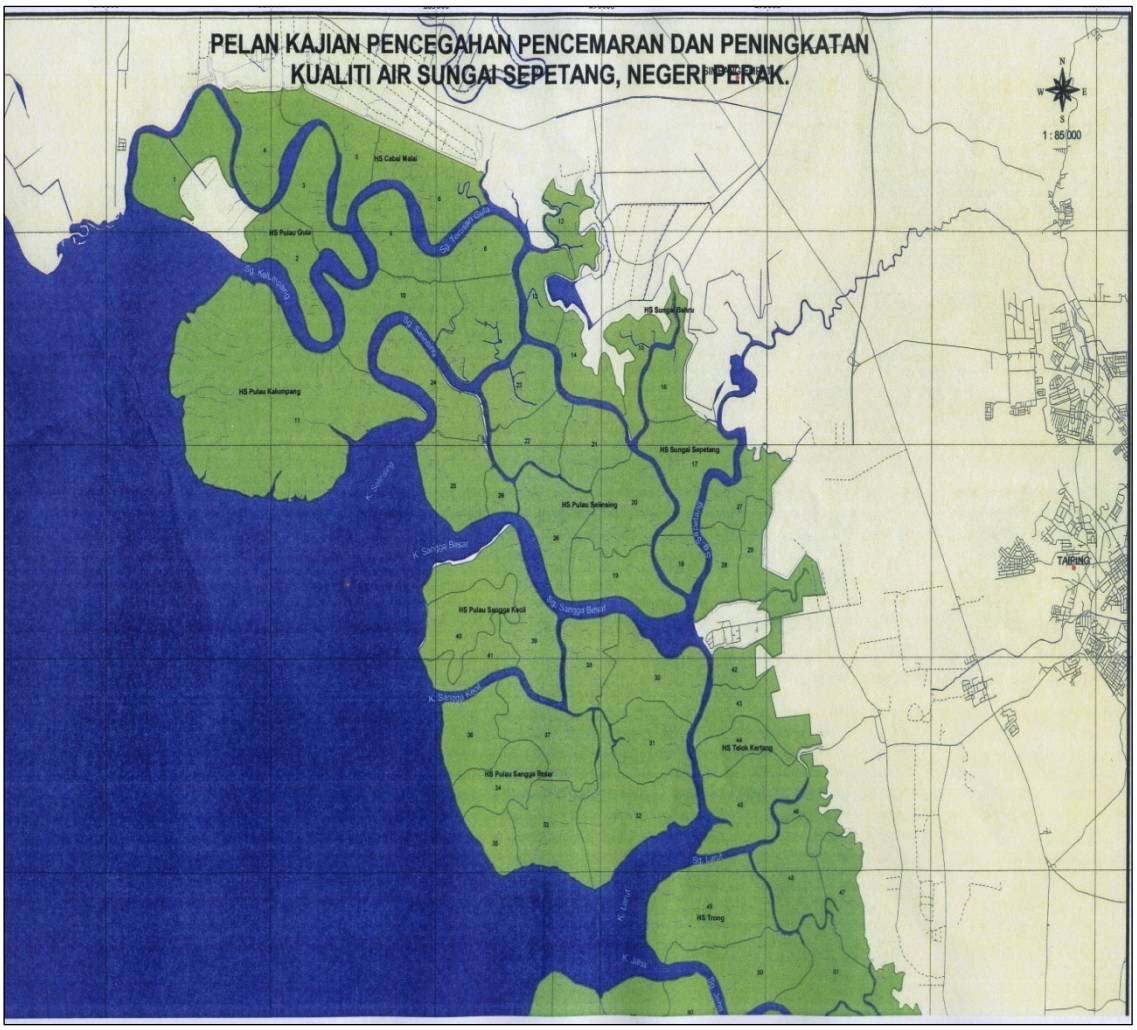

Figure 24: Matang Forest Reserve at the river-mouth of Sepetang River

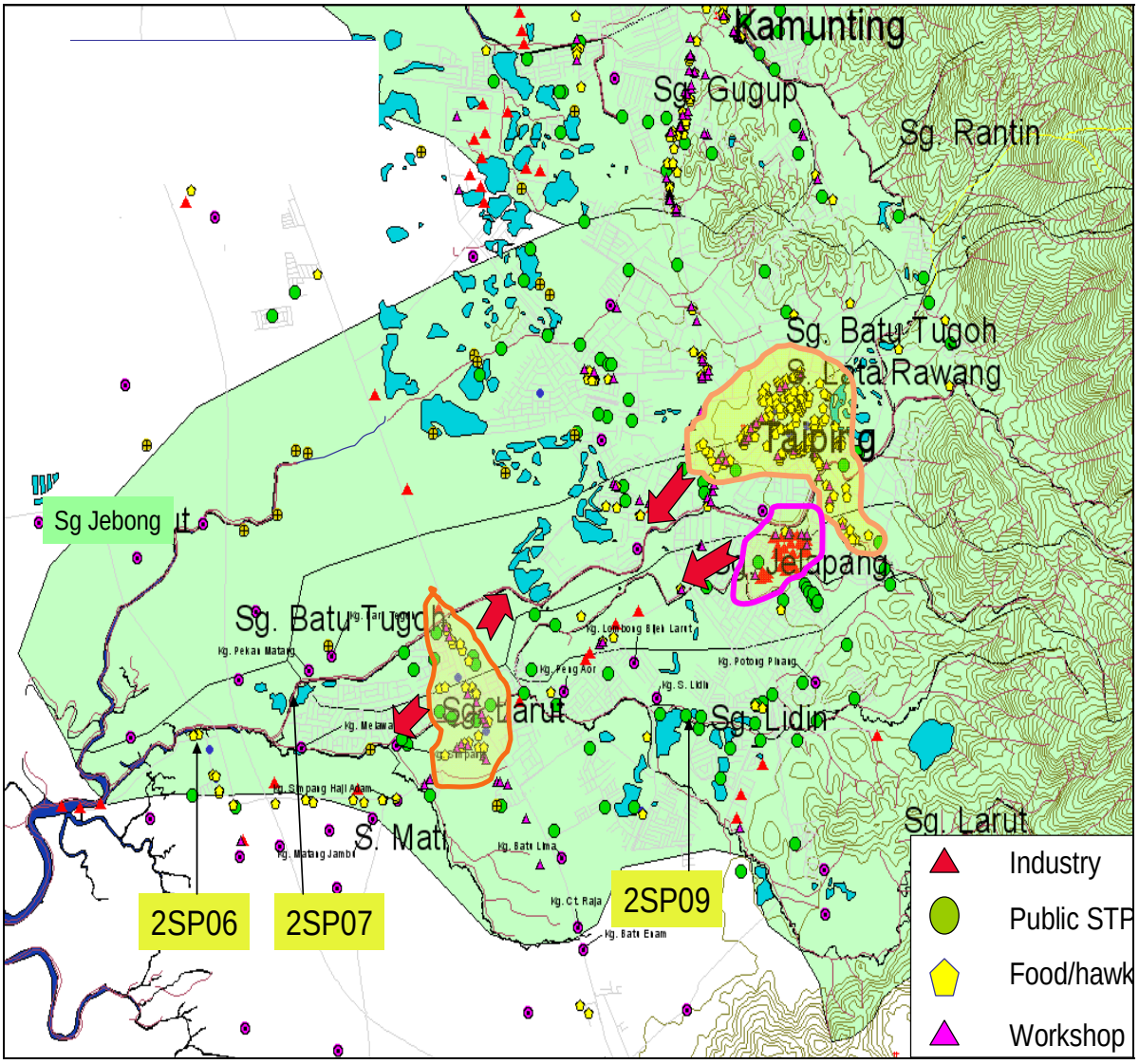

Figure 25: Zoning of Industrial Area, Kamunting

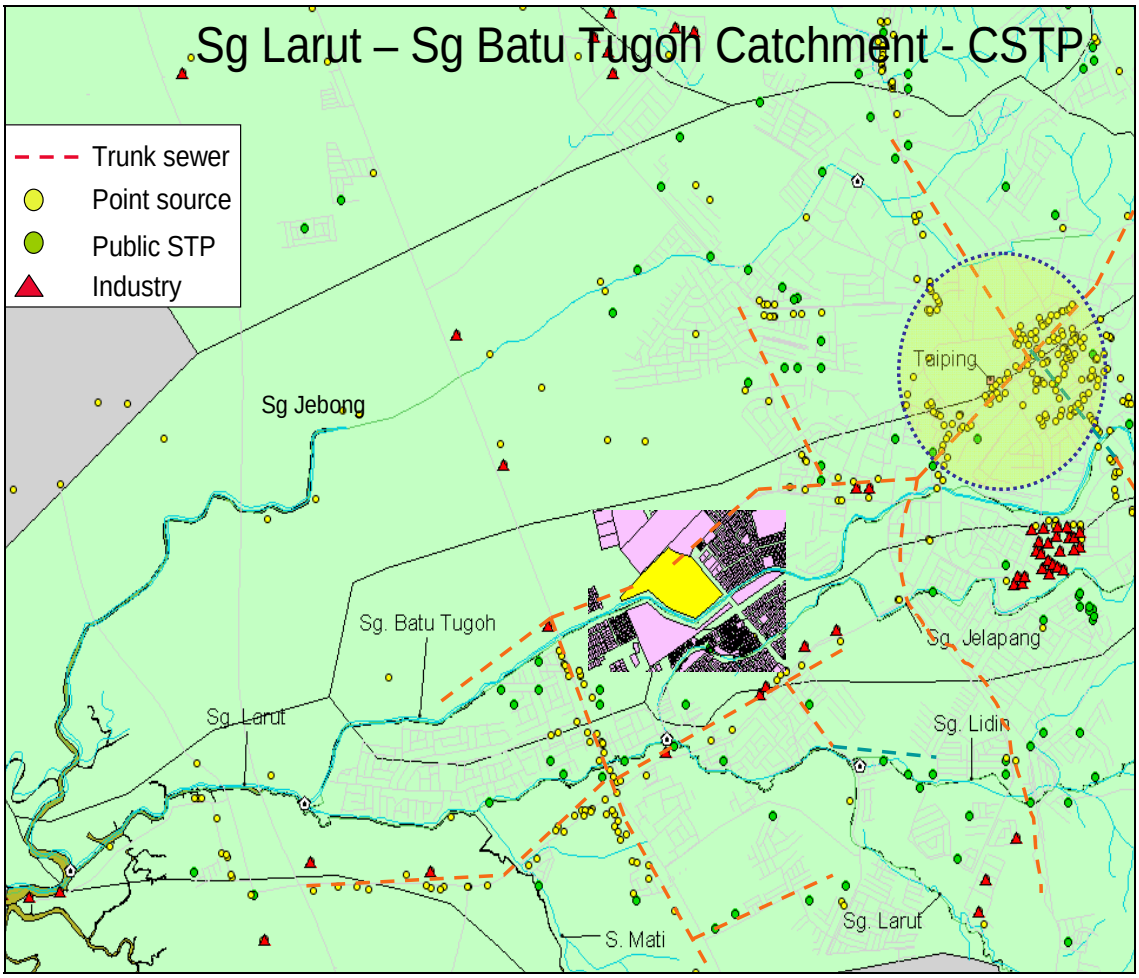

Figure 26: Sewerage Management for Taiping.

Figures were adopted from Kuala Sepetang Master Plan, 2007, Department of Environment, and Ministry of Natural Resources and Environment/ Malaysia.

APPENDIX 2

QUESTIONNAIRE SHEET

Kaji selidik ini bertujuan untuk mengenalpasti jumlah perbelanjaan yang ditanggung oleh firma untuk melindungi alam sekitar. Soalan kaji selidik ini menjurus kepada perbelanjaan yang ditanggung oleh syarikat dalam melindungi alam sekitar. Contohnya, apakah langkah-langkah yang perlu diambil untuk mengurangkan afluen (emission), mengurus sisa buangan pepejal ataupun mengurangkan pencemaran ke sungai yang berdekatan. Kajian ini juga ingin mengetahui apakah langkah-langkah yang diambil untuk mengurangkan pencemaran alam sekitar, seperti penjimatan penggunaan input utama seperti bahan tenaga ataupun menggunakan input dengan lebih berkesan. Perbelanjaan untuk mengurus alam sekitar tidak termasuk perbelanjaan untuk aspek kesihatan dan keselamatan pekerja. Kajian ini dibiayai sepenuhnya oleh Kementerian Sumber Asli dan Alam Sekitar, Malaysia, dan dikendalikan oleh Unit Perundingan, Universiti Malaya.

The purpose of this survey is to find out how much industry spends annually on protecting the environment. This surveys include questions about spending on measures to reduce various types of environmental impacts. For example, measures to reduce emissions and discharges, dispose of and treat waste, reduce noise pollution, etc. The survey also seeks information on the benefits derived from actions taken during the year, which reduce the impacts on the environment, such as saving from using raw materials more efficiently. Nevertheless, deprection/write-offs and payments of the general environmental taxes are not included in this survey. Expenditure on polluton abatement does not include health, safety, aesthetics or employee comfort. This study has been fully commisioned and funded by the Ministry of Natural Resources and Environment to the Consultancy Unit (UPUM) of the University of Malaya.

A. PERKARA: STATUS OPERASI SYARIKAT
A. ITEM : OPERATIONAL STATUS

A1. Tandakan kotak yang berkenaan
A1. Check one box which best describes the facility

☐ Dalam operasi/ *In Operation*

Tidak beroperasi untuk sementara, berapa lama
Temporarily Idle
Dijual atau disewa kepada syarikat lain.
Tarikh dijual

Bulan	Tahun

Sold or leased to another company		

Nama/*Name*:
Alamat/*Address*:

A2. Nyatakan jika kaji selidik ini dilakukan untuk lokasi (site), bahagian ataupun syarikat keseluruhannya. *(Please specify whether the following information is filled in for a site, division, or the whole company or others.)*

Lokasi/*site*	Bahagian/*Division*	Seluruh/*Whole Company*

JADUAL A2 / TABLE A2

Bilangan tenaga buruh/pekerja di syarikat ini pada 13/12/2006 *Number of persons employed in the company (as of 31/12/2006)*	
Jumlah jualan untuk tahun 2006 *Company turnover in 2006*	
Jumlah perbelanjaan modal *(paid up capital)* apabila operasi dimulakan: *Initial paid up capital:* Perbelanjaan Pembangunan *(Development Expenditure)*	
Perbelanjaan Pengurusan *(Operating expenditure)*	
Jumlah modal berbayar lima tahun kebelakangan *(5 years average)* (2000-2006) *Total paid up capital in the last 5 years of operation (2000-2006)*	

A3. Firma/Premis yang dikaji terlibat dalam bidang berkenaan (Pangkah satu):
A3. This company is involved in the following activities (tick one)

a. Pakaian/ fabrik/ tekstil *(Textile/ Clothing)*
b. Mekanik bengkel kereta motor *(Workshop)*
c. Restoren Makanan *(Food Restaurant)* & Kilang Berasaskan Makanan *(Food based products)*
d. Sarung tangan/getah *(Hand Gloves)*
e. Kimia *(Chemical*)
f. Perkhidmatan Perubatan *(Clinical Waste Treatment)*
g. Kilang Kelapa sawit (Palm oil refineries)
h. Tapak Pelupusan Sampah *(Landfill)*
i. Perhotelan *(Hotel)*

j. Elektronik *(Electronic)*
k. Another

A4. Sekiranya firma terlibat dengan bidang perkhidmatan perubatan, adakah premis mem-punyai insinarator tersendiri untuk merawat buangan sisa bahan perubatan.

A4. Do you have your own incenarator plant to treat waste if you are operating under Clinical Waste Treatment

Ya/ Yes ☐ No/ Tidak ☐

A5. Sekiranya firma terlibat dalam bidang mekanik bengkel kereta, adakah premis menjual balik minyak pelincir yang sudah digunakan kepada pembeli berdaftar/ berlesen?

A5. If your company is an operating workshop, do you sale your grease/used lubricant oil/ by products to licence or non-license dealer?

Ya/ Yes ☐ No/ Tidak ☐

B. PENGURANGAN PENCEMARAN, PEMBUANGAN DAN KITAR SEMULA
B. Pollution Abatement, Disposal and Recycling

1. Aktiviti pengurangan pencemaran/*Pollution Abatement*
Tandakan (X) untuk aktiviti pengurangan pencemaran yang berlaku di fasiliti pada tahun 2006
Please indicate (mark X) the pollution activities which occured at this facility in 2006

Jadual B/ *TABLE B*

	Pencemaran udara *(Air pollution)*			**Afluen *(Effluent)***			**Sisa pepejal *(Domestic waste)***		
	Ya / *Yes*	Tidak / *No*	Tidak Tahu / *Don't know*	Ya / *Yes*	Tidak / *No*	Tidak Tahu / *Don't know*	Ya / *Yes*	Tidak / *No*	Tidak Tahu / *Don't know*
a. Teknik fizikal/ *Physical Technique (gravity decomposition, inertial separator, containment,*									

dehydration, screening, landfilling, underground injection well)									
b. Teknik biologi/ biological techniques (biological filtration, activated sludge, phyotoremediation , activated sludge dewatering, multiplate reactor, composting, land farms)									
c. Teknik kimia/ Chemical techniques (scrubbing, desulfurization, oxidation, reduction, neutralization)									
d. Teknik termal *(incineration, oxidation, pyrolysis)*									

C. PERKARA: (Kos dan perbelanjaan pengurangkan pencemaran) berasaskan pendekatan `end-of-pipe'.

C. ITEM: *Expenditure associated with the operation of pollution control of abatement equipment (end-of-pipe)*

Peralatan 'end of pipe' merupakan peralatan yang diguna untuk merawat, mengendalikan, mengukur ataupun membuang sisa lepasan (emissions) hasil proses pengeluaran. Tetapi ini **tidak termasuk** peralatan yang digunakan, ataupun sebahagian yang digunakan untuk proses pengeluaran **(di bawah Jadual C2B).** Contoh peralatan (end-of-pipe) termasuklah loji rawatan sisa dan sistem penapis. Nyatakan perbelanjaan modal dan operasi syarikat (tidak termasuk cukai) ke atas peralatan "end-of-pipe" yang digunakan untuk mengawal pencemaran yang digunakan dalam tahun 2006 dan ini termasuklah kos peralatan dan pemasangan.

*'End-of-pipe' equipment is used to treat, handle, measure or dispose of emissions and waste form production, but **NOT** equipment which is used, or as part of, production process or installation (covered in **Table C2B** below). Examples of*

'end-of-pipe' equipment include effluent treatment plant and exhaust air scrubbing systems. What was your company's total capital expenditure and and operating expenditure on the 'end-of-pipe' pollution control equipment (inclusive of equipment and installations cost) in 2006?

C1. Kos dan perbelanjaan pengurangan pencemaran berasaskan kaedah "end-of-pipe' mengikut jenis pencemaran

C1. *This section covers in-house-expenditure associated with the operation of pollution control of abatement equipment (end-of-pipe)*

JADUAL C1/*TABLE C1*

	Pencemaran udara ***(Air pollution)***		**Bahan Berbahaya** ***(toxic waste)***		**Sisa pepejal** ***(solid waste)***		**Afluen** ***(Effluent)***	
	RM	**%**	**RM**	**%**	**RM**	**%**	**RM**	**%**
Perbelanjaan modal untuk mengurangkan pencemaran *(Pollution abatment capital expenditure)*								
Kos operasi untuk mengurangkan pencemaran *(Pollution abatement operating costs)*								
Maklumat tiada atau tidak dikumpulkan *(Information not available or not collected to provide an an estimatation)*								

C2. PERKARA: PENGHALANG PENCEMARAN/PERBELANJAAN MODAL BERASASKAN PENDEKATAN BERSEPADU

C2. ITEM: Integrated Pollution Prevention/Integrated capital Expenditure

C2A. Tanda (X) ke atas proses mengurangkan pencemaran yang berlaku di sepanjang tahun
2006

C2A. *Please indicate (mark X) the polluton prevention which occured at this facility in 2006.*

C2B: Kaedah mengawal pencemaran di bawah merupakan yang lebih bersepadu di mana aktiviti pengeluaram yang baru ataupun diubahsuai yang direka supaya perlindungan alam sekitar adalah sebahagian dari proses pengeluaran yang lebih bersepadu. Contohnya, untuk afluen, syarikat memasang mesin untuk menjimatkan air ataupun menggunakan semula air.

***C2B**: Integrated capital Expenditure relates to new or modified proction facilities, which have been designed so that environmental protection is an integaral part of the process. For example (wastewater – installations for reductions in water use & reused water),*

JADUAL C2B /TABLE C2B

	Ya/*Yes*	**Tidak/*No***	**Tidak tahu/ *Don't know***
1. Proses dan prosidur yang diubahsuai *1. Process or procedure modifications*			
2. Mereka bentuk semula produk akhir (Nyatakan tahun dilakukan) *2. Redesign or reformulate of products*			
3. Menggantikan ataupun mengubah suai peralatan dan teknologi *3. Substitution or modification of equipment or technologies*			
4. Penggunaan semula, kitar semula dan menggunakan semula bahan sisa buangan *4. In process recycling, recovery, recirculation, and reuse of materials*			
5. Membaiki ataupun mengubahsuai serta melatih semula kakitangan untuk mengendalikan inventori/asset yang digunakan untuk langkah mengawal pencemaran *5. Improvements or modifications to housekeeping, maintenance, training or inventory control*			
6. Membaiki ataupun mengubahsuai segala bocoran dan tumpahan *6. Improvements or modifications to prevent leaks and spills*			
7. Lain-lain. Nyatakan di bahagian G3 *7. Other? Please specify in the section for remarks, item G3*			

C2C: Sekiranya anda menyatakan "YA" kepada aktiviti di atas, nyatakan jumlah kos (modal dan pengurusan) ke atas aktiviti berkenaan

***C2C:** If you answer 'YES' to any of the activities stated above, report the total cost and expenditures incurred by those activities.*

JADUAL C2C /TABLE C2C

	Pencemaran udara *(Air pollution)*		**Bahan Berbahaya** *(toxic waste)*		**Sisa pepejal** *(solid waste)*		**Afluen** *(Effluent)*	
	RM	**%**	**RM**	**%**	**RM**	**%**	**RM**	**%**
Perbelanjaan modal untuk mengurangkan pencemaran *(Pollution abatement capital expenditure)*								
Kos operasi untuk mengurangkan pencemaran *(Pollution abatement operating costs)*								
Maklumat tiada atau tidak dikumpulkan *(Information not available, or not collected to provide an estimatation)*								

D. PERKARA: PENGURANGAN PENCEMARAN, PEMBUANGAN DAN KITAR SEMULA

D. ITEM: Pollution Abatement, Disposal and Recycling

JADUAL D/TABLE D

	Perbelanjaan Modal		**Perbelanjaan/ kos operasi**		**Tiada operasi**	
	RM	**%**	**RM**	**%**	**RM**	**%**
1. Penstoran di tapak (on site) untuk sisa berbahaya *On site storage cost for (hazardous/ toxic waste)*						
2. Kitar Semula di tapak untuk sisa berbahaya *On-site recycling cost for hazardous/ toxic waste)*						
3. Kos pengangkutan yang ditanggung untuk menghantar sisa buangan berbahaya ke Kualiti Alam Malaysia						

(Perbelanjaan tahunan) *Annual transportation cost/ expenditure to transport hazardous/ toxic waste to Kualiti Alam Malaysia.*						
4. Kos pengangkutan yang ditanggung untuk menghantar sisa pepejal ke Majlis Perbandaran untuk dilupuskan *Annual transportation cost/ expenditure to transport solid waste to landfills managed by the Local Authority*						

E. PERKARA : PENJIMATAN KOS DAN PENDAPATAN (*Cost Savings and Income)*

E. ITEM: Bahagian ini merujuk kepada penjimatan kos ataupun pendapatan akibat daripada perbelanjaan/ proses yang berlaku pada tahun 2006 yang menyumbang kepada pemulihan alam sekitar

E1. *This section covers cost savings or income arising from the expenditure or process changes taken in 2006 which had resulted in environmental improvements.*

JADUAL E1 /*TABLE E1*

Penjimatan kos tahunan akibat daripada: ***Annualised cost saving resulting from:***	**RM (nilai/value)**	**%**
1. Menggunakan bahan gantian *1. Improved used of substitution of raw materials*		
2. Mengurangkan penggunaan air dan bahan sisa buangan *2. Reductions in water use or production of effluent*		
3. Menggurangkan penggunaan bahan api/ tenaga *3. Reductions in energy use*		
4. Menggurangkan kos pelupusan *4. Savings in waste disposal cost*		
5. Lain-lain *5. Others*		

F. PERKARA: PERBELANJAAN TAMBAHAN YANG DILAKUKAN UNTUK MELINDUNGI ALAM SEKITAR (KREDIT CUKAI DAN SUBSIDI)

F: OTHER ENVIRONMENTAL PROTECTION EXPENDITURE (TAX CREDITS AND SUBSIDIES)

F. Adakah syarikat menerima sebarang pengecualian kredit dan subsidi dari aktiviti pemuliharaan alam sekitar yang dilakukan di bawah **Jadual E1**? Pengecualian cukai ataupun subsidi dilakukan ke atas perbelanjaan modal dan perbelanjaan pengurusan. Contohnya, firma boleh menerima cukai kredit untuk menggunakan bahan kitar semula ataupun menggunakan tenaga kerja untuk melakukan kitar semula dalam proses pembuatan. Sebaliknya, firma boleh menerima keutamaan melalui subsidi untuk menggunakan bahan tertentu apabila menggunakan bahan guna semula dalam produk akhir.

*F. Please indicate if your company receives any tax credits or subsidies as a result of any of the expenditure in items under **Table E1**. The tax credit or subsidy must be the result of a pollution or other environmental expenditure and may be for the capital and/operating expenses. For example, a facility may receive a state tax credit for the use of recycles, as a result of incorparating recycling into the manufacturing process, or a facility may receive a subsidy for using a certain percentage of recycled content in the final product.*

JADUAL F/ TABLE F

Pembersihan tapak melalui subsidi/bantuan kerajaan ***If the facility received tax credits or subsidies***	**Jumlah (RM)**	**Tiada maklumat**
A. Menggunakan teknologi mesra alam melalui insentif Alam Sekitar dari MIDA (Malaysian Industrial Development Authority) *Using environment friendly techniques under **i**ncentives for environmental management (MIDA)*		
B. Pemulihan habitat berasaskan penglibatan komuniti setempat *Local community participation as sponsor*		
C. Mengawas (monitoring) dan melakukan ujian ke atas parameter alam sekitar *Environmental monitoring and testing*		
D. Mengurus program alam sekitar *Administration of environmental research or conservation project)*		

G. PERKARA: SISTEM LAPORAN ALAM SEKITAR
G. ITEM: Environmental Reporting and Auditing System)

JADUAL G/ TABLE G

G1. Adakah anda melaporkan perbelanjaan untuk melindungi alam sekitar mengikut sistem seperti di bawah? ***G1. Do you separately identify environmental protection expenditure in any of the following?***	**Ya/*Yes***	**Tidak/*No***
a. Sistem perakaunan pengurusan *a. Management Accounting System*		
b. Akaun terakhir *b. Financial accounts*		
c. Data yang diterbitkan daripada sistem pengurusan alam sekitar *c. Generated by an evironmental Management system*		
d. Sumber-sumber lain dan nyatakan d. Other sources, please specify		

G2. Adakah segala maklumat dalam perkara G1(a-d) dilaporkan dalam: ***G2. Is some or all of the information in G.1(a-d) also externally reported in:***	**Ya/*Yes***	**Tidak/*No***
a. Laporan tahunan dan akaun tahunan *a. The annual reports and accounts*		
b. Laporan alam sekitar *b. An environmental report*		
c. Tanggungjawab sosial koporat ataupun laporan mapan dari syarikat *c. Social corporate responsibility through business sustainability report*		
d. Lain-lain *d. Others*		

G3. Nyatakan sama ada syarikat anda akur kepada sistem pengurusan alam sekitar/ piawaan seperti Sistem Pengurusan Alam Sekitar(EMS), ISO14001 dan lain-lain.

G3. Please indicate whether your company is in compliance with any environmental management system or standard such as EMS, ISO 1400 or others? Please specify.

H. PERKARA: BAYARAN TAMBAHAN
H. ITEM: Other payments

H1. Nyatakan bayaran tambahan dalam kategori yang berpatutan
H1. Report the amount of other payments in the appropriate categories below

A. Bayaran kepada pihak kerajaan dilakukan melalui: *(Payments to government through)*:	**JUMLAH /*Amount*(RM)**	**TIADA MAKLUMAT *(Information not available or not collected to provide estimate)***
1. Lesen (Permohonan dan tahunan)cukai *1. License/Processing and yearly*		
2. Denda dan penalti *2.Fines and penalties*		
3. Lain-lain *3. Others*		

I. PERKARA : MAKLUMAT TAMBAHAN DAN UMUM
I. ITEM: Additional and general information

a. Nyatakan kapasiti rawatan *(capacity of treatment pond)* loji penapis air buangan *(waste water)* di premis anda*:*
a. State the capacity of treatment pond) for your effluent discharge:

_____ m^3/hari (m^3/day)(m^3/s)

b. Nyatakan purata kepekatan afluen (*average concentration in effluent)* ke atas parameter berikut :
b. State the average concentration in waste water for the following parameter:

i. Bio-chemical Oxygen Demand (BOD)(mg/l)

_____

ii. Chemical Oxygen Demand (COD)(mg/l)
mg/l
_____

iii. Suspended Solids (TSS)(mg/l)
mg/l
_____

iv. Oil and grease (mg/l)
mg/l
_____

c.1 Pelupusan sisa pepejal (solid waste) dari proses pengeluaran dari kilang ini adalah melalui:

c.1 Disposal of solid waste from your production process is treated through:

Insinirator/Incenarator ☐ Tapak pelupusan sampah/ Landfills ☐

Lain-lain: Nyatakan *(Others, please specify)* _____

c.2 Pelupusan sisa bahan berbahaya (toxic waste) dari proses pengeluaran dari kilang ini adalah melalui tapak pelupusan berlesen:

c.2 Disposal of toxic waste from your production process is treated through licensed secured landfill

Ya/ *Yes* ☐ Tidak / No ☐

d. Adakah premis ini mempunyai loji rawatan sisa *(sewage treatment plant)* yang dibina dengan:

d. Is your sewage tretment plant built based on:

i) Terasing dari sistem IWK *(independent from IWK)* ☐

ii) Berkait dengan sistem IWK *(Integrated and connected to IWK)* - ☐

f. Nyatakan nilai perbelanjaan untuk mengendalikan perkara d (i) – d (ii):

f. State the cost incured for item d (i) – d (ii)

d (i) _____ (RM/ setahun/ *year*)
d (ii) _____ (RM/ setahun/ *year*)

TERIMA KASIH DI ATAS KERJA SAMA ANDA. ALAM SEKITAR UNTUK SEMUA

THANK YOU FOR YOUR COOPERATION. NATURAL ENVIRONMENT FOR ALL

APPENDIX 3

WATER QUALITY STANDARDS

There are two (2) criteria to be met by any treatment process discharging effluent to an inland waterway; one concerns the receiving water and the other the discharge water.

- **Receiving Water Quality Standard**:

  Under the Interim Water Quality Standard (INWQS), Malaysian rivers are classified according to the six Classes and as described in Table 1.

  - Note:
    The Department of Environment (DOE) initiated the development of receiving Water Quality criteria for Malaysia in 1985 which aimed at developing a water quality management approach for the long term water quality of the nation's water resources. The Water Quality Consultancy Group of the Institute of Advanced Studies, University of Malaya was commissioned in 1985 to undertake Phase I Study for the development of water quality criteria and standards for Malysia. The study recommended that Malaysian rivers be classified according to the six classes and described in Table 1.

- **Discharge Quality Standard:**

  The effluent quality of any discharge from a sewage treatment process to inland water (that is, other than one having an ocean outlet) shall meet the minimum requirements of the Environmental Quality Act 1974 and the limits set down by the Environmental Quality (Sewage Industrial Effluent Regulations, 1979) which is presented in Table 2.

- Note:
  Standard A criteria applies only to catchments areas located upstream of drinking water supply off-takes.

Table 1 - Receiving Water Quality (from INWQS)

Parameters	(Units)	Classes					
		I	IIA	IIB	III	IV	V
DO	mg/l	7	5 - 7	5 - 7	3 - 5	< 3	< 1
COD	mg/l	10	25	25	50	100	> 100
BOD	mg/l	1	3	3	6	12	> 12
Total Dissolved Solids	mg/l	500	1000	-	-	4000	-
Total Suspended Solids	mg/l	25	50	50	150	300	> 300
Faecal Caliform	counts/100ml	10	100	400	5000	5000	-
Total Coliform	counts/100ml	100	5000	5000	5000	5000	>50000

Table 2 - Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979. Maximum Effluent Parameter Limits Standards A and B.

	Parameters	(Units)	Standard	
			A (1)	B (2)
1	Temperature	^{o}C	40	40
2	pH	-	6.0 - 9.0	5.5 - 9.0
3	BOD5 @ 20oC	mg/l	20	50
4	COD	mg/l	50	100
5	Suspended Solids	mg/l	50	100
6	Mercury	mg/l	0.005	0.05
7	Cadmium	mg/l	0.01	0.02

8	Chromium, Hexalent	mg/l	0.05	0.05
9	Arsenic	mg/l	0.05	0.10
10	Cyanide	mg/l	0.05	0.10
11	Lead	mg/l	0.10	0.5
12	Chromium, Trivalent	mg/l	0.20	1.0
13	Copper	mg/l	0.20	1.0
14	Manganese	mg/l	0.20	1.0
15	Nickel	mg/l	0.20	1.0
16	Tin	mg/l	0.20	1.0
17	Zinc	mg/l	1.0	1.0
18	Boron	mg/l	1.0	4.0
19	Iron (Fe)	mg/l	1.0	5.0
20	Phenol	mg/l	0.001	1.0
21	Free Chlorine	mg/l	1.0	2.0
22	Sulphide	mg/l	0.50	0.50
23	Oil and Grease	mg/l	Not detectable	10.0

1. Standard A for discharge upstream of drinking water take-off
2. Standard B for inland waters

Water Classes and Uses:

Class	Uses
I	Represents water bodies of excellent quality. Standards set for the conservation of natural environment in its undisturbed state. Water bodies such as those in the national park areas, fountain heads, and in land and in undisturbed areas come under this category where strictly no discharges of any kind are permitted. Water bodies in this category meet the most stringent requirements for human health and aquatic life protection.
II	Represents water bodies of good quality. Most existing raw water supply sources come under this category. In practice, no body contact activity is allowed in this water for the prevention of probable human pathogens. There is a need to introduce another class for water bodies not used for water supply but similar quality which may be referred to as Class IIB. The determination of Class IIB standards is based on criteria for recreational use and protection of sensitive aquatic species.

lll Is defined with the primary objective of protecting common and moderately tolerant aquatic species of economic value. Water under this classification may be used for water supply with extensive/advanced treatment. This class of water is also defined to suit livestock drinking needs.

lV Defines water required for major agricultural activities which may not cover minor applications to sensitive crops.

V Represents other water which does not meet any of the above uses. See table 3.

Table 3- Water Classes and Uses

CLASS	USES
	Conservation of natural environment.
Class I	Water Supply I - Practically no treatment necessary.
	Fishery I - Very sensitive aquatic species.
Class IIA	Water Supply II - Conservation treatment required.
	Fishery II - Sensitive aquatic species.
Class IIB	Recreational use with body contact.
Class III	Water Supply III - Extensive treatment required.
	Fishery III - Common, of economic value and tolerant species.
Class IV	Irrigation.
Class V	None of the above.

Table 4- DOE Water Quality Classification Based On Water Quality Index

SUB INDEX & WATER QUALITY INDEX	INDEX RANGE		
	CLEAN	SLIGHTY POLLUTED	POLLUTED
Biochemical Oxygen Demand (BOD)	91-100	80 - 90	0 - 79
Ammoniac Nitrogen (NH3 –N)	92-100	71 - 91	0 - 70
Total Suspended Solid (SS)	76-100	70 - 75	0 - 69
Water Quality Index (WQI)	81-100	60 - 80	0 - 59

Source: **Malaysian Environmental Quality Report 2006**

Department of Environment

Ministry of Natural Resources and Environment/

Malaysia