CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Management of the natural environment is becoming an increasingly important issue to manufacturing firms. In response to this phenomenon, literature on environmental regulations in the context of corporate strategy is rapidly growing. The analysis of the impact of environmental regulations on firm strategies and industrial performance has led to a wide variety of academic and practitioner perspectives and prescriptions.

The Importance of Pollution Prevention

According to Reinhardt (1998), the debate about business and the environment is polarized. On the one hand, it has been argued that environmental regulation enhances economic performance in an efficiency-producing, innovation-stimulating symbiotic relationship (Gore, 1992; Porter, 1991). On the other hand, regulations are assailed as generating costs that businesses will never recover, representing financial diversions from vital productive investments (Gingrich, 1995; Walley & Whitehead, 1994). Even though there were a number of empirical studies devoted to clarify this issue, the findings were unfortunately divergent and inconclusive, fostering an ongoing debate in the literature.

Many theorists try to explain this equivocal relationship between environmental performance and economic performance. Ullmann (1985) criticizes those prior studies on methodological shortcomings. Some researchers explore further how firms might gain competitive advantage in ways other than the framework of waste / efficiency cost savings. It is within this latter initiation that a concept of pollution prevention as the right approach of environmental strategy for gaining competitive advantage was emerging. Some empirical studies reported that pollution prevention was associated

with enhanced manufacturing performance. Since the late eighties pollution prevention has become a concept which is extensively used to influence the behavior of companies in a more environmental friendly direction. In 1990, through the Pollution Prevention Act, Congress of the United States established a national policy to prevent or reduce pollution at its source whenever feasible. Pollution prevention projects have been carried out in various countries and with various designs (Hoftman and Koottatep, 2001).

Application of Resource-Based Theory to Pollution Prevention Concept

Resource-based theory takes the perspective that competitive advantage is rooted inside a firm, in assets and capabilities that are valuable and inimitable, which are nurtured and applied to an appropriate external environment so that a firm can develop a viable strategy. However, this theory is criticized that it has used a narrow and parochial concept of external environment that emphasizes political, economic, social, and technological aspects to the virtual exclusion of the natural environment (Shrivastava & Hart, 1992; Stead & Stead, 1992). Given the growing magnitude of ecological problems, this omission has rendered resource-based theory inadequate as a basis for identifying important emerging sources of competitive advantage. Hart's (1995) work addressed this issue by expanding the resource-based view of the firm to include the constraints imposed and opportunities offered by the natural environment to formulate the environmental strategies that best fit with societal demand of cleaner environment. He also pointed out that there are two modes of environmental strategies. The first is the control mode: emissions and effluents are trapped, stored, treated, and disposed of using pollution-control equipment. The second is the prevention mode: emissions and effluents are reduced, changed, or prevented through better housekeeping, material substitution, recycling, or process innovation. In addition, he predicted that proactive environmental strategies could lead to the development of firm-specific capabilities, which can be sources of competitive

advantage. Sharma and Vredenburg's (1998) comparative case study confirmed Hart's prediction. Their research found the evidence of the development of a capability for stakeholder integration, a capability for higher-order learning, and a capability for continuous innovation in firms that having proactive environmental strategies.

The resource-based view of the firm is also exploited by Russo and Fouts (1997) in their empirical study of the environmental performance – economic performance relationship. Their hypotheses are that firms that tend toward the control mode will differ in their resource bases from those that tend toward prevention mode and that this strategy choice will affect firms' ability to generate profits. They tested those hypotheses with an analysis of 243 firms over two years. Results indicate that the resource-base view of the firm can be applied fruitfully to corporate social responsibility issues. They also found evidence that high levels of environmental performance are associated with enhanced profitability, and this relationship strengthens in higher-growth industries. However, they did not test to gain insight on which environmental strategy choice (pollution control and pollution prevention) yields the most acute bottom-line effects.

Klassen and Whybark (1999) attempted to fill this void by exploring the debate from two perspectives: the resource-based view of the firm and manufacturing strategy. They reported that significantly better manufacturing performance was found in those plants where management investment in the environmental technology portfolio was increasingly allocated toward pollution prevention technologies. In contrast, manufacturing performance worsened as the proportion of pollution control technologies increased. They concluded that the capability to implement pollution prevention technologies was a strategic resource, whereas implementing pollution control offered no competitive advantage.

1.2 RESEARCH RATIONALE

Based on the empirical studies of Russo and Fouts (1997) and Klassen and Whybark (1999) mentioned above, it seems logical to say that greening via pollution prevention pays. Consequently, pollution prevention (or, in other terms with the close meaning: waste minimization, clean technology, cleaner production, eco-efficiency, and resource reduction) has become the very important concept since the late eighties in influencing the behavior of firms in a more environmentally friendly direction (Hofman & Koottatep, 2001). In 1994, the United Nations Environment Programme (UNEP) referred cleaner production as a cornerstone of successful sustainable development (UNEP, 1994). The actions of various government and non-government organizations in the last five years have tended to support this concept and many industries and businesses are continually encouraged to adopt waste preventive measures in their systems and processes of production.

Although there are over fifty international organizations, national donors and non-profit organizations funding multinational programs in Asia with many millions of dollars annually to promote cleaner production while national and local organizations also commit substantial resources in kind to the common objective, the rate of adoption remains frustratingly slow. The common topic of conversation at the Second Conference of the Asia Pacific Roundtable for Cleaner Production in Brisbane was: "If it is obvious that cleaner production is good for business, why isn't everyone doing it?" (Stevenson, 2001).

The approach of both the international donors and the many local organizations and governments with which they cooperate in promoting clean technology has been based largely in the belief that if information, skills and financing are made available, and industry leaders are shown directly how clean technology can help them, many others will soon seek the available resources and emulate the leaders. Stevenson

(2001) argued that this approach might work in a fully rational world and with perfect access to information. He further criticized that much of the enormous collective effort to reduce industrial pollution and to promote clean technology in Asia had focused on one or more of an array of specific initiatives, from market-based instruments to demonstration firms, from greening the supply chain to access to financing, and on a long list of worthwhile but relatively narrowly focused solutions. He believed that much more could have been accomplished in the last decade toward establishing clean technology if the international donors had pressed harder on policy makers and policy influencers to integrate clean technology concepts into the public policies of the many aspects of economic activity that impact the environment and the natural resource base.

The author of this study would like to argue that Stevenson's suggestion is just a part of the holistic view. He focuses only on the institutional factors, i.e., the regulatory pressures, the stakeholder demands, the incentives for adoption of clean technology, and the isomorphic power created by the widespread of clean technology. What he wants to see is that these institutional factors are addressed at the integrated national level. In fact, other two factors, i.e., the organizational factors and the management factors, should be put into the approach for accelerating and broadening the adoption of principles of clean technology. The author proposes this argument based on the integration of the resource-based theory, the institutional perspective from organization theory, and the diffusion of innovation theory.

1.3 RESEARCH QUESTIONS

There are three research questions in this study as follows:

1. Which institutional factors and to what extent do they have significant positive effects on the adoption of clean technology by manufacturing firms in Thailand.
2. Which organizational factors and to what extent do they have significant positive effects on the adoption of clean technology by manufacturing firms in Thailand.
3. Which management factors and to what extent do they have significant positive effects on the adoption of clean technology by manufacturing firms in Thailand.

1.4 RESEARCH OBJECTIVES

Objectives of this study are as follows:

1. To verify whether the success of clean technology promotion in Thailand depends on the institutional factors (i.e., environmental laws and regulations, stakeholders, incentives provided for adopters of clean technology, and widespread of clean technology), the organization factors (i.e., firm size, firm capabilities, and firm knowledge about clean technology), and the management factors (i.e., perceived advantages of clean technology and management's willingness to adopt / develop clean technology).
2. To identify the extent to which the attribute of each factor contributes to the adoption of clean technology by the manufacturing firms in the food processing industry and the electrical / electronics industry in Thailand.
3. To suggest the effective approaches to improve the promotional strategy of clean technology in Thailand.
4. To obtain the data concerned with the adoption of clean technology by the manufacturing firms in the food industry and the electrical / electronics industry in Thailand. Such data are the important reference for other future researches.

1.5 RESEARCH CONTRIBUTIONS

The contributions of this research include the followings:

1. Theoretical contribution

a) This research aims to settle the debate over whether environmental protection poses a threat or opportunity for business. In addition, the benefits gained from environmental performance are traditionally quoted via the normative approach. This research, on the contrary, will use the empirical findings to confirm that the management's perceived advantages gained from the clean technology adoption are significantly related to the clean technology adoption.

b) This research uses the interdisciplinary approach that bases on the integration of the resource-based theory, the institutional perspective from the organization theory, and the diffusion of innovation theory to develop a new model for describing factors that enhance the adoption of clean technology by manufacturing firms in Thailand. The study provides the test of that proposed model by the statistical analyses in order to find the significant relationship between the dependent variable, i.e., the adoption of the clean technology, and the independent variables, i.e., the institutional factors, the organizational factors, and the management factors.

2. Practical Contribution

a) The results of this study will be used to confirm that the conventional approach that put efforts only on the institutional factors is not enough for the success of the clean technology promotion in Thailand. The organizational factors and the management factors also play major roles in accelerating and broadening the adoption of this vital concept.

b) This study aims to encourage the policy makers and policy influencers to incorporate the organizational factors and the management factors into their

considerations and invent the advanced effective approaches that categorize the manufacturing companies by their sizes, capabilities, and knowledge of clean technology so that the promotional strategies for each company category are prepared to fit with their characteristics and constraints.

c) This study will categorize the respondents' clean technology investment by company type (i.e., Thai-owned companies, foreign-owned companies, and the joint-venture companies), employees' education level, major export market, and sales volume. Any finding from this initiation is the good basis for the clean technology promoter to design and use the appropriate strategy in approaching the management of each company type. Otherwise, all the efforts will reach only the lower-level personnel of the manufacturing companies instead of the top management who have the authority to adopt / develop clean technology.

1.6 SCOPE OF THE STUDY

The scope of this study is confined to the manufacturing firms in the electrical and electronics industry and the food processing industry in Thailand. These industries are chosen because of the following justifications:

1. They are the two largest exporters of Thailand (see Appendix 1) and subject to the effect of many environmental laws and regulations locally and internationally.
2. The manufacturing activities of these two industries are so huge, which lead to the implication that they tend to be the major sources of pollution in Thailand. Hence, any finding that initiates the improvement of environmental performance within these two industries is considered as the significant contribution of this study.
3. Food processing industry has been involved with the clean technology at the early implementation stage of pollution prevention projects in Thailand. This makes the comparative study to investigate the effects of institutional factors between these two industries with different degree of exposure to the clean technology.

4. Electrical and electronics industry in Thailand is the late mover in terms of clean technology. This industry is now subject to the developing pressure, which is arising from the proposals for a directive of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE), and on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Therefore, the study of this industry under such condition provides the important information relating to the adoption level of clean technology by the electrical and electronic manufacturing firms in Thailand.

Electrical Industry

This sector can be divided into 3 groups as follows:

1. Consumer electrical products include air-conditioners, refrigerators, electric fans, washing machines, etc.
2. Industrial electrical products include transformers, electric motors and generators, converters and inductors, battery, etc.
3. Electrical components and parts include compressors for refrigerators and air-conditioners, electric cables, air conditioner parts, refrigerator parts, fan parts, etc.

Electronics Industry

This sector can be grouped into 4 categories as follows:

1. Consumer electronic products include televisions, videocassette recorder, electronic watch and clock, radio and audio products, etc.
2. Computer and peripheral devices.
3. Industrial electronic products include coy machines, telephones, switching equipment, transmission apparatus, etc.
4. Electronic components and parts include integrated circuits, color CRT, diodes, transistors, printed circuit boards, mini motor, capacitor, resistor, connector, electronic wires and cables, ball bearing, computer parts, etc.

Food Processing Industry

This industry comprises of 4 sectors as follows:

1. Fruit and vegetable food – processing sector.
2. Meat, poultry, and seafood sector.
3. Beverage and fermentation sector.
4. Dairy sector.

1.7 DEFINITION OF TERMS

In order to facilitate a better understanding of this study, some of the terms used are defined as follows:

- **Adoption of Clean Technology**

  Adoption is a decision to make full use of innovation as the best course of action available (Rogers, 1983). Clean technology is defined as a measure to improve or adjust production processes or products, so that consumption of raw materials, energy and natural resources is accomplished efficiently, with minimum waste or none at all. It is pollution reduction at source, including substitution of raw materials, recycling and re-using, which will help conserve the environment and simultaneously reduce production costs (Department of Industrial Works, 2000). Hence, clean technology adoption implies that a manufacturing firm makes a decision to use this kind of technology with the purpose to reduce the environmental impacts at the source by considering the inputs rather than the outputs in the search to produce more goods with less waste and emission. Optimizing the use of all inputs in production, i.e., raw materials, energy, natural and human resources, is the approach of the manufacturing firm that adopts clean technology. Consequently, clean technology adoption is measured in terms of the investment of this innovation in the respondent's manufacturing plant.

- **Regulatory Pressures** are the state and societal forces that exert on the manufacturing firms to conform to public demands and expectations, i.e., pollution abatement via promoting the adoption of clean technology by government regulators and international organizations.
- **Stakeholder Demands** are the environmental protection requirements of those who are directly related to an organization and have the ability to impact its bottom line directly. These stakeholders include customers, suppliers, employees, shareholders, competitors, the federation of Thai industries, and community.
- **Clean Technology Incentives** are the benefits in terms of grants, loans, funding, and privileges, i.e., waiving of operation permit fees and exemption of income tax and / or import duty on clean technology equipment, etc., given to the manufacturing firms that adopt the clean technology.
- **Widespread of Clean Technology** is the awareness of the management of manufacturing firms about the widespread or broadly diffused of the clean technology in their industries, competitors' plants, and neighboring companies.
- **Size of Firm** is a dimension of the manufacturing firms, which is measured in terms of their total assets and the number of employees.
- **Capabilities of Firm** are the capabilities of the manufacturing firms measured in terms of their technology intensive degree, their advancement in developing their own technology, and their modernized production machines and equipment.
- **Clean Technology Knowledge of Firm** is the knowledge of clean technology that the manufacturing firms receive from the organizations that promote the diffusion of clean technology, such as government agencies, consulting firms, vendors, NGOs, academic institutes, and the federation of Thai industries.
- **Perceived Economic Advantage** is the top management's perception on the economic profitability of clean technology.

- **Perceived Competitive Advantage** is the top management's perception on the competitive advantage of clean technology. According to Hill and Jones (1995), competitive advantage of a company comes from its high efficiency, high quality, high innovation, and high customer responsiveness.
- **Perceived Social Advantage** is the top management's perception on the social advantage of clean technology.
- **Willingness** is the management's intents to adopt and develop clean technology in their firms.
- **Recycling and Reuse** is used interchangeably. However, there is a slight distinction between the two. If a material can be used with minimal treatment, the term reuse is more appropriate, whereas a material that has undergone a significant amount of treatment may be considered to be recycled. For example, when a beer producer cleans and refills bottles, it is a case of reuse. But when glass bottles are crushed and used for making asphalt, it is a case of recycling.
- **HACCP** stands for Hazard Analysis and Critical Control Point Systems. They are a set of rules for poultry, meat, and seafood processors. HACCP regulations replace an inspection system based on sight and smell with scientific methods that require meat-processing facilities to reduce harmful pathogens and bacteria.

1.8 ORGANIZATION OF THE DISSERTATION

This dissertation is comprised of six chapters. Chapter One starts with an overview of the background and the main issue for the study. It describes the gap of conventional approach for clean technology promotion in Thailand and proposes the new model to close this gap. On this basis, the research questions, research objectives, research contributions, and scope of the study are presented in this chapter. Chapter Two reviews the literature concerning with the resource-based theory, the institutional theory, the diffusion of innovation theory, and the clean technology. Chapter Three proposes a research model for this study and the hypotheses settings. Chapter Four presents research methodology used in this study, which includes operational definitions, construct operationalization, and research design. Chapter Five provides data analysis and results, which includes descriptive statistics, data examination, validity and reliability test, bivariate correlations, analysis of variance, stepwise multiple regression analysis, and hypothesis testing. Questionnaire response rate is also presented in this chapter. Chapter Six, the final chapter, focuses on a discussion of the results, implications, limitations of this study, future research, and conclusion.