

The Benefits Analysis of Environmental Management Investment in Taiwan's Industries

¹ Shiaw-Wen Tien, ² Yi-Chan Chung,
³ Chih-Hung Tsai, and ⁴ Wen-Chuan Su
^{1,4} Graduate School of Technology Management
Chung-Hua University
Taiwan, ROC
E-mail: swt@chu.edu.tw

^{2,3} Department of Industrial Engineering and Management
Ta-Hwa Institute of Technology
Hsin-Chu, Taiwan, ROC
E-mail: ietch@thit.edu.tw

Abstract

This study utilized questionnaires to investigate the status of environmental management (EM) activities at current Taiwan's manufacturers, specifically speaking firms that were ISO 14001 approved and were either covered in "Ten-hsia" magazine's 1997 Socially Responsible Companies Investigation or earned ROC Environmental Protection Awards. This study probed the question "How do different industry characteristics and different extents of engagement in environmental management activities affect the financial investment in and benefits derived from environmental management?" Factor analysis, one-factor analysis of variables (ANOVA), and description statistics were the tools used in analysis. The findings of this study were as follows: (1) tests concerning environmental management budgeting and investment indicated that over the next five years manufacturers' financial backing for environmental management activities will be deeply affected by the extent of environmental management promotion activities they are

currently performing. In addition, in the future manufacturers will place an increasing emphasis on environmental management, investing greater capital and providing more and more environmental management activities. (2) questionnaire results revealed that current manufacturers executing environmental management activities do not glean commensurate financial benefits. This study maintains that this phenomenon is due to the fact that Taiwan's companies head continue to adopt a passive attitude toward environmental management promotion activities: the amount of capital invested in environmental management is still insufficient; the history of environmental management activities is still too short; and firms are still not capable of effectively implementing environmental management promotion activities.

Keywords: ISO 14001, Environmental Management (EM)

1. Introduction

Environmental protection will be a topic of the utmost importance in the 21st century and environmental management (EM) has already become a prerequisite for any firm wishing to survive long term in today's highly competitive business environment. Effective EM activities should be an indispensable part of any firm's effort to tackle the dual challenge of economic growth and proper environmental protection. However, at present there are still many companies that look on EM as a burden possessing the potential to diminish corporate profit while offering no concrete benefits that would stimulate increased profits. The amount of capital and resources spent on EM cannot, in the short run, produce an obvious revenue benefit; therefore firms come to look on EM as an encumbrance. However, there is now much evidence that EM activities can save resources, reduce waste, open up unlimited business opportunities and thus produce greater profits. In "The Green Management Handbook" Sadgrove [2] points out that the benefits of EM include increased sales volume, decreased cost, greater competitiveness and improved corporate image. Lu Wen-hsien (1997) [1] maintains that executing EM activities can, in addition to helping a firm achieve higher profits, save on capital, increase efficiency, broaden market share, improve corporate reputation /image, and enable proper adherence to laws and regulations, thus avoiding penalty/fines, etc. Therefore corporations that hope to achieve long lasting success should look to EM for long-term benefits. Companies that have implemented EM believe firmly in its usefulness, while companies that have yet to engage in EM regard it with fear and dubiousness. This stark contrast in attitudes prompted this study of the benefits of investment in EM.

This study utilized questionnaires to ascertain the status of current industry efforts to promote EM and the benefits derived from EM. The objectives of this study were as follows: (1) to investigate the status of Taiwan's manufacturers' current EM efforts; (2) to analyze the factors that influence EM involvement and investment; (3) to analyze the extent of benefits that firms have derived from EM.

2. Literature Review

2.1. The Environmental Management (EM)

Kalassen and McLaughlin (1996) [16] maintain that EM can be defined as the effort to minimize the negative effects of products on the environment. Winn and Roome (1993) [18] define EM as the management of the negative effects of products and processes on living and non-living beings and on cultural systems. Chang Ting-ting (1998) [8] says that EM is the organizing of a firm's resources, viewed from the standpoint of product life, to minimize the negative effect of corporate activities have on the environment.

2.2. The Benefits of Environmental Management (EM)

In addition to benefiting the environment, EM brings many tangible and intangible benefits to corporations themselves. Table 1 describes the benefits a company can expect to gain from implementation of EM, as interpreted by domestic and international scholars Sally (1998) [17], Ku Yang (1997) [14], Lu Wen-hsien (1997) [1], Yang Yi-jung (1996) [12], and Wen Yao-lin (1996) [5].

Table 1: The benefits of Implementing EM

EM Benefits	Sally [17]	Ku [14]	Lu [1]	Yang [12]	Wen [5]
1. Sales Volume Increase		*			
2. Order Increase		*			
3. Profit Increase	*		*		
4. Production Cost Reduction	*		*	*	
5. Production Capacity Increase	*		*		
6. Product Reliability Increase	*		*		
7. Company Reputation/Image Improvement	*		*	*	*
8. Market Share Increase			*		*
9. Customer Confidence in Product Increase	*	*			*
10. Customer Complaint/Claim Reduction		*			*
11. Better Company-Public Interaction				*	*
12. Product Competitiveness Increase	*		*		

This study combined the insights of scholars Sally, Ku Yang, Lu Wen-hsien, Yang Yi-jung and Wen Yao-lin to derive the above-listed twelve benefits of EM. These twelve items were used as the basis for review in the questionnaire.

2.3. The Investment in Environmental Management

As companies face more stringent environmental protection (EP) demands, their decisions regarding investment in EM are growing tougher and more complex. Huang Pei-hao (1998) [11] and Chen Ming-tao (1992) [10] have said that a firm's decision concerning investment in EP is influenced by a number of factors: (1) laws, rules and regulations; (2) the stance of regulatory agencies (EPA, Economic Bureau, etc.); (3) the clout of environmental

protection, political and social action groups; (4) the focus of the media; e.g. national, regional or local protests; (5) the status of competition; e.g. the stance of competitor manufacturers and the attitude of customers; (6) the status of Taiwan's technological advancement; e.g. the effects of environmental protection measures; (7) the ability of corporations to adjust to environmental protection policies; (8) the ability of corporations to integrate manufacturing technologies; (9) the ability of the executors EP to accommodate specialized knowledge; (10) the size of the predicted return on the firm's investment. As the academic world seldom makes recommendations on investment methods, the collected comments of the above-mentioned scholars are a valuable reference for corporations that wish to promote EM.

3. Research Method

3.1. The Research Framework

The basic framework employed in this study is described in Fig. 1 below. This study investigated how differences in industry characteristics and degrees of advancement in

the implementation of EM affect a manufacturer's amount of involvement in and benefit derived from EM.

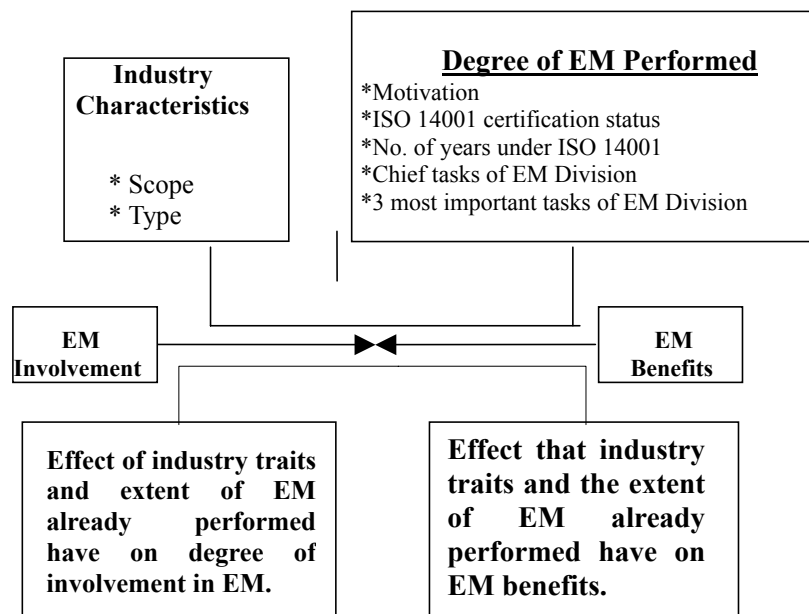


Figure 1: The Research Framework

3.2. The Validation Model

This study investigates how differences in industry characteristics and differences in the extent to which EM has been promoted affect corporate EM budgeting and the benefits derived from EM. This study's testing model was established by referencing the testing models of Henry [15], Yeh Yin-hua and Ma Chun-mei [13], Chang Yu-shan and Chiang Shu-chen [7], and Ma Chia-ying [3] and by investigating the literature review concerning investment in environmental protection, EM and the benefits of EM.

Model 1: How differences in industry characteristics and the degree of EM promotion activities performed affected manufacturers' budgeting for EM. The testing model established is shown below.

$$EMI = f(IC, EMD, X)$$

EMI: Manufacturer's involvement in EM.

IC: Industry characteristics ~ including whether stocks were listed or over-the-counter and differences in the field of manufacturing specialization, capital, and the average amount of sales profit over the last three years.

EMD: The extent of advancement of EM activities, i.e., whether or not ISO 14000 certification has been obtained, the number of years under certification, whether or not the employees responsible for EM are full or part time, the number of staff devoted to EM and the salary of the EM staff.

X: Other factors.

Thus Model 1 describes how the manufacturer's choice of degree of involvement in EM is affected by industry characteristic differences, differences in the extent of EM activities performed and other factors.

Model 2: Based on Model 1, Model 2 was established to show the benefits of executing EM.

$$\begin{aligned} \text{EME} &= g(\text{EMI}, Y) \\ &= H(\text{IC}, \text{EMD}, X, Y) \end{aligned}$$

EME: The benefit to manufacturers of implementing EM.

EMI: The extent of involvement in EM. This study investigates the influence industry characteristics and the degrees of EM performed have on the benefits derived from EM.

Y: Other factors.

Therefore Model 2 describes how the degrees of benefits manufacturers derive from implementing EM is influenced by the current level of involvement in EM and other factors. By inserting the factors from Model 1 into Model 2, we can see that industry characteristics, the extent of current involvement in EM and other factors affect EM benefits.

3.3 The Research Hypotheses

Using the models established, this study subjected four categories of hypotheses to testing.

Hypothesis 1: Different industry characteristics do not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 1-1 (H_0): Industry characteristics do not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 1-2 (H_0): Amount of capital does not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 1-3 (H_0): Sales amount over the last three years does not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 1-4 (H_0): Whether stocks were listed or over-the-counter does not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 2: Differences in the extent of involvement in EM do not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 2-1 (H_0): Whether or not ISO 14001 certification has been obtained does not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 2-2 (H_0): The number of years under ISO 14001 certification does not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 2-3 (H_0): Differences in the levels of EM tasks performed do not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 2-4 (H_0): The number of staff devoted to EM activities does not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 2-5 (H_0): The salary of the staff devoted to EM activities does not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 3: Industry characteristics do not influence the benefits manufacturers derive from EM.

Hypothesis 3-1 (H_0): Industry characteristics do not influence manufacturers' benefits derived from EM.

Hypothesis 3-2 (H_0): The size of capital does not influence manufacturers' benefits derived from EM.

Hypothesis 3-3 (H_0): Average total sales over the last three years do not influence manufacturers' benefits derived from EM.

Hypothesis 3-4 (H_0): Whether stocks are listed or over-the-counter does not influence manufacturers' benefits derived from EM.

Hypothesis 4: Differences in the extent of involvement in EM do not influence the amount of benefits manufacturers derive from EM.

Hypothesis 4-1 (H_0): Whether or not ISO 14001 certification has been obtained does not influence manufacturers' benefits derived from EM.

Hypothesis 4-2 (H_0): The number of years under ISO 14001 certification does not influence manufacturers' benefits derived from EM.

Hypothesis 4-3 (H_0): Differences in the levels of EM activities performed do not influence manufacturers' benefits derived from EM.

Hypothesis 4-4 (H_0): The number of staff devoted to EM activities does not influence manufacturers' benefits derived from EM.

Hypothesis 4-5 (H_0): The salary of the staff devoted to EM activities does not influence manufacturers' EM budgeting and financial investment in EM.

Hypothesis 4-6 (H_0): The amount of involvement in EM does not influence manufacturers' benefits derived from EM.

3.4. The Research Subjects

This study's population can be divided into three categories. The first category consisted of those companies that obtained a 1st through 7th place ranking in the competition for the "ROC Corporate Environmental Protection Award" awarded by the Taiwan's government's Executive Yuan [9]. After companies that had obtained such a ranking more than once were eliminated, the number of firms stood at 57. The second category consisted of

manufacturing firms [4] that were covered in “Ten-hsia” magazines 1997 Socially Responsible Companies Investigation. After 14 companies that overlapped with the first category were eliminated, the number of firms from this category stood at 56. The third category consisted of 80 firms that were noted in the September, 1997 report on EM listing manufacturers that had obtained ISO 14001 certification. After 11 companies that overlapped with the first or second category were eliminated, the number of firms from this category stood at 80 [6]. Thus the grand total consisted of 182 firms. Questionnaires were sent out from February 20, 2002 to March 25, 2002 and 85 replies were received.

3.5. The Questionnaire Design

This study’s questionnaire comprised three parts. The first part consisted of basic information concerning manufacturers and their scope of operations: the type of industry engaged in, amount of capital, the average sales over the last three years, and whether stocks were listed or over-the-counter. The second part consisted of the extent to which the manufacturer pursued EM. The questions

in this section described the firm’s current status of EM activity promotion; i.e. the division in charge of EM, the number of staff in the division and their salaries, the principal duties and three most crucial tasks of the division, how budgeting and financial support for EM, what degree of financial backing is provided, etc. The third part consisted of EM benefits. The questions in this section elucidated the influence manufacturers’ execution of EM activities had on benefits. This study combined the insights of scholars Sally, Ku, Lu, Yang and Wen to derive the twelve benefits of EM promotion activities listed in Table 1.

In the first part of the questionnaire, the basic information section, and the second part, the description of EM promotion activities, a nominal scale and numerical values were used. In the third part, the operational effectiveness measurement index, a Likert 5-point scale was utilized. A value of “5” indicated a high level of effectiveness, “3” indicated no change, and “1” indicated a decrease in effectiveness. The measurement standard is described below in Table 2.

Table 2: Measurement Standard

Marked- 5	Moderate- 4	No Difference- 3	Moderate Lack- 2	Marked Lack- 1
Influence > 10%	Influence of 5~10%	Influence (or Lack of) < 5%	Lack of Influence > 5~10%	Lack of Influence > 10%

3.6. The Questionnaire Data Analysis Method

To evaluate the open questionnaire data, this study used a SPSS software package to

perform statistical analysis consisting of the following:

1. Description Statistics: This study used description statistics to determine frequency of occurrence and derive the sample distribution.
2. Factor Analysis: This study referenced

the works of Sally, Ku, Lu, Yang, and Wen and selected twelve benefits that manufacturers gain from implementing EM. The weight of each factor corresponding to each index item represented the degree of correspondence between the index item and the factor. Three common factors emerged that accounted for 68.2% of total variance. The first of these three was the "Production Benefit" factor, which was related to 5 index items: "Profit Increase," "Production Cost Reduction," "Production Capacity Increase," "Product Reliability Increase," and "Customer Complaint/Claim Reduction". The second common factor, "Sales Benefit," accounted for 12.7% of the variance and was related to 3 index factors: "Sales Volume Increase," "Order Increase," "Market Share Increase." The third common factor, "Image/Competitiveness Benefit" accounted for 11.2% of the variance and was related to 4 index items: "Company Reputation/Image Improvement," "Customer Confidence in Product Increase," "Better Company-Public Interaction," and "Product Competitiveness Increase". Thus, in this study factor analysis was used to distill the original 12 items to three common factors, thus making it possible to more systematically comprehend EM benefit factors.

3. One Factor Analysis of Variance: This study used one factor analysis of variance (ANOVA) to ascertain whether the effects of factors exhibited significant difference.

4. Conclusions

Analysis results yielded the conclusions stated below.

4.1. Trend Analysis

There are two primary motivations for executing EM: external and internal. External forces may demand that a company adopt EM; for example, a firm may turn to EM to adhere to a law or regulation, to obtain ISO 14001 certification or in order to keep up with industry trends. On the other hand, the decision to engage in EM may come from within the firm, either because the firm recognizes its responsibility for protecting the natural world or because it wishes to reduce cost. Here we can see the attitude of companies towards the promotion of EM is no longer a matter of simply being passively coerced by the government or the trends of the time, but has become a self-motivated activity. This change of attitude indicates that companies are gradually coming to recognize the importance of EM.

According to manufacturers, the greatest benefits EM offers are in terms of heightened company reputation and image. Less marked benefits were seen in the areas of cost reduction, interaction between company and the public, increase in consumer confidence in products, and increase in competitiveness. Therefore the results of this study show that current manufacturers still adhere to the belief that EM activities principally affect outside factors (i.e. customers, competitors) and produce little impact on the internal workings of the firm itself.

4.2. Test Results

Table 3 illustrates how the test results matched up with the proposed hypotheses.

1. The results concerning the effect of characteristics of different industries and financial support for the manufacturer's involvement in EM indicate these two

- factors do not influence each other. Perhaps a salient degree of correspondence did not emerge because all types of manufacturers are now involved in EM promotion activities. The questionnaire results indicated that the probable factors accounting for a manufacturer's extent of financial backing for EM include the degree of importance placed on EM, laws, and the scope of impact production has on the environment. Factors such as the amount of capital and sales and whether the firms' stocks were listed or over-the-counter seemed to have a negligible effect on EM budgeting.
2. In examining the test results concerning the relationship between the manufacturer's degree of involvement in EM and the amount of financial support allotted for EM, we found that the financial backing designated for EM over the next five years was deeply affected by the extent of EM activities currently being carried out. It seems that in the years to come, manufacturers will place greater and greater emphasis on EM and will be willing to invest an increasingly large amount of capital in EM promotion activities.
 3. Test results concerning the relationship between industry characteristics and the benefit of implementing EM indicated that only one item—"Sales Benefit"—was affected by the firm's field of specialization. "Production Benefit" and "Image/Competitiveness Benefit" were not seriously affected. These results indicate that some manufacturers that have been executing EM have already exhibited improvement in terms of "Sales Benefit," i.e. total sales, order quantity, and market share.
 4. Test results concerning the relationship between the manufacturer's degree of investment in EM and the benefit of EM exhibited correspondence between the manufacturer's "Production Benefit" factor vs. the number of years the manufacturer has obtained ISO 14001 certification as well as between the "Image/Competitiveness Benefit" factor vs. the financial investment in EM over the next five years. However, the majority of the hypothesis factors did not exhibit such relationships. Probable reasons for this include the following: the attitude of company heads towards EM promotion activities is passive, the investment in EM promotion activities is insufficient, the history of EM promotion activities is short, consumers do not place sufficient importance on green products and green consumption, and manufacturers do not effectively promote EM activities. As long as these outdated attitudes and situations remain in place, manufacturers will not be able to glean the full benefits of EM.

Table 3: Composite Hypothesis Test Results

Hypothesis Number	Hypothesis Content		Test Results
1-1	Manufacturers' industry characteristics (the fact that they are from different industries) do not influence the benefits they derive from EM.		Confirmed
1-2	Manufacturers' amount of capital does not influence their budgeting and financial investment in EM.		Confirmed
1-3	Manufacturers' average amount of sales profit does not influence their budgeting and financial investment in EM.		Confirmed
1-4	Whether manufacturers' stocks are listed or over-the-counter does not influence their budgeting and financial investment in EM.		Confirmed
2-1	Whether or not manufacturers have obtained ISO 14001 certification does not influence their budgeting and financial investment in EM.	2002	Confirmed
		Next 5 years	Rejected
2-2	The number of years manufacturers have been under ISO 14001 certification does not influence their budgeting and financial investment in EM.	2002	Confirmed
		Next 5 years	Rejected
2-3	The fact that manufacturers are engaged in different levels of EM activities does not influence their budgeting and financial investment in EM.		Confirmed
2-4	The number of employees manufacturers devote to EM does not influence their budgeting and financial investment in EM.		Rejected
2-5	The salary of manufacturers' employees devoted to EM does not influence their budgeting and financial investment in EM.		Rejected
3-1	Manufacturers' industry characteristics (the fact that they are from different industries) do not influence the amount of benefits they derive from EM.	Production Benefit	Confirmed
		Sales Benefit	Rejected
		Image/Competitiveness Benefit	Confirmed
3-2	Manufacturers' amount of capital does not influence the amount of benefits they derive from EM.		Confirmed
3-3	Manufacturers' average sales profit over the last three years does not influence the amount of benefits they derive from EM.		Confirmed

3-4	Whether or not manufacturers' stocks are listed or over-the-counter does not influence the amount of benefits they derive from EM.	Production Benefit		Confirmed
		Sales Benefit		Rejected
		Image/Competitiveness Benefit		Confirmed
4-1	Whether or not manufacturers have obtained ISO 14001 certification does not influence the amount of benefits they derive from EM.			Confirmed
4-2	The number of years manufacturers have been under ISO 14001 certification does not influence the amount of benefits they derive from EM.	Production Benefit		Rejected
		Sales Benefit		Confirmed
		Image/Competitiveness Benefit		Confirmed
4-3	The fact that manufacturers are engaged in different levels of EM does not influence the amount of benefits they derive from EM.			Confirmed
4-4	The number of employees manufacturers devote to EM does not influence the amount of benefits they derive from EM.			Confirmed
4-5	The salary of manufacturers' employees devoted to EM does not influence the amount of benefits they derive from EM.			Confirmed
4-6	Manufacturers' extent of involvement and financial investment in EM does not influence the amount of benefits they derive from EM.	2002		Confirmed
		Next 5 years	Production Benefit	Confirmed
			Sales Benefit	Confirmed
			Image/Competitiveness Benefit	Rejected

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