

Article

Analysis on the Relationship between Green Accounting and Green Design for Enterprises

Jui-Che Tu and Hsieh-Shan Huang *

Graduate School of Design, National Yunlin University of Science and Technology, Yunlin 640, Taiwan; E-Mail: tujc@yuntech.edu.tw

* Author to whom correspondence should be addressed; E-Mail: r3.go@msa.hinet.net; Tel.: +886-7-721-3963; Fax: +886-7-722-1267.

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Abstract: Green design is advocated and developed in response to the increasingly deteriorating global environment, but its implementation is only based on the morality of the entrepreneurs, without economic incentive and legal restraint. As a result, green design has not been widely adopted. In recent years, the European countries, the U.S., Japan, the UN and Taiwan have successively promoted environmental accounting guidelines and required enterprises to disclose environmental improvement information, so as to improve the environment through production that will unavoidably impact product manufacturing. How product design should respond to this trend is a concern of this study. This study adopted the KJ (Kawakita Jiro) method and the meta-research method to analyze the influence factors. Then, it was discussed whether green design is feasible. The results showed that the requirements of green accounting include: expanding corporate social responsibility, production cannot be exempted from environmental protection, the manufacturing of clean products can generate pollution, the external production cost should be internalized, the redesign to improve the product production process and packaging, reducing resource waste and implementing the (Reduce, Recycle, Reuse) 3R policy, lifecycle assessment for all assessments and developing environmentally-friendly products, which can be solved with green design.

Keywords: green accounting; product design; green design; sustainable development

1. Introduction

Human activities have led to damages to the environment, including depletion of natural resources, environmental pollution and abnormal climates. The global consensus at present is to promote sustainable development, among which corporate social responsibility (CSR) is most closely associated with business. Many countries around the world have mandated enterprises to establish green accounting and to disclose environmental information for the reference of interested parties. The Ministry of Environment Japan defined green accounting as “quantitative assessment of the expenditures and benefits in environmental protection activities” and specified “systematic records and reports, maintenance of a positive relationship between the enterprises and the natural ecology, and promotion of effective and efficient environmental activities, in order to achieve sustainable development”. The green accounting system in EU countries, such as Denmark and the Netherlands, is required by law to disclose environmental information to the government. Countries that have not legislated related laws, such as the U.S. and Japan, have mandated some enterprises to disclose environmental information. In Taiwan, the government has provided guidance to promote the green accounting system. In Vietnam, the government enacted the Environmental Taxation Act in 2010 [1]. Multinational corporations are increasingly concerned with whether their suppliers have disclosed green accounting information before proceeding with transactions. It is obvious that green accounting has become a mainstream trend in the world, and legislation of related laws is necessary. Once green accounting is enforced by the government, enterprises are required to internalize the external costs of the production activities, thus increasing the production and operational costs. Hence, in order to maintain the current profits or to lower costs, enterprises must make improvements in product design, such as green innovation or product redevelopment. The impact on product R&D and production will be unavoidable. To address this problem, this study aims to analyze the impacts according to the Green Accounting Guidelines and to apply the concept of green design for product redesign. The findings can provide a reference for enterprises to prepare for the green trend.

2. Literature Review

Environmental accounting, also known as green accounting, is to measure, record and disclose the impacts of corporate environmental activities on its financial status through a set of accounting systems. The definitions of green accounting in different countries are similar, as shown in Table 1.

Table 1. Definitions of green accounting in different countries (compiled by this study).

Country and name	Regulations or definitions
Denmark, 1995 Green Accounts Act [2]	About 1200 high-pollution enterprises must announce green accounting report. Besides, 200 enterprises voluntarily provide the reports.
Netherlands, 1999 Environmental Management Act [2]	About 260 enterprises are compelled to disclose the environmental report. Besides, 40 enterprises voluntarily provide the reports.
U.S. Environmental Protection Agency, 1995 An Introduction to Environmental Accounting As A Business Management Tool [3]	Environmental cost accounting means adding environmental cost information to the current cost accounting system, identifying hidden environmental cost and allocating it to proper products or manufacturing.

Table 1. *Cont.*

Country and name	Regulations or definitions
UN Division for Sustainable Development 2001 Environmental Management Accounting (EMA) [4]	Regarding corporate cost, product design production and investment decision-making, EMA can provide immediate and visionary information. EMA is also the decision-making and support tool. The information system allows the firms to manage environmental lifecycle and economic information and to acquire better information and environmental protection strategies.
International Federation of Accountants, 2005 Environmental Management Accounting Guidelines [5]	Environmental management accounting manages environmental and economic performance by development and execution of a proper environmental accounting system, including reports and auditing of corporate information and environmental management accounting. Generally speaking, it includes lifecycle accounting, total cost accounting, an effective process and strategic planning of environmental management.
Ministry of the Environment, Japan, 2005 Environmental Accounting Guidelines [6]	Green accounting is a quantitative assessment of the cost and effectiveness of enterprises in environmental protection activities. Enterprises are required to have systematic records and reports and are guided to maintain a positive relationship with ecological environment to implement effective and efficient environmental activities. The final goal is to accomplish sustainable development.
Environmental Protection Administration, Taiwan, 2008 Industrial Environmental Accounting Guidelines	By measurement, records, analyses and explanation, enterprises' resources invested in environmental improvement and protection and executive outcomes are completely and consistently reorganized, and the outcomes are provided to stakeholders of enterprises.

As seen above, green accounting is to use lifecycle assessment to measure the environmental impacts of corporate activities, promote the use of clean production, adopt total cost assessment and combine traditional accounting to disclose the environmental financial information of the enterprises. The purpose is to urge enterprises to implement effective and efficient environmental activities, so as to achieve sustainable development.

Green accounting makes environmental expenditure a part of operational cost; thus, new thinking should be adopted for product design, in order to maintain the existing profits, enhance environmental performance or meet the green accounting rules. The new product design concept should meet the environmental requirements on product development and production. As the common goal of product design is to solve various problems, namely a concept of logical thinking instead of data computation of production technology, product design should be based on the thinking and analysis of the “concept”, thus accomplishing the design according to the concept [7]. The current green concept is to improve the environment, restore the ecology and maintain sustainable operation. Green design is environment oriented; in other words, environmental concerns carry the same weight as profitability in the product design and development process [8].

3. Research Design

3.1. Research Method

Although green accounting has become a norm around the world, it is still in the promotion stage in many countries. Along with the advocacy of sustainable development, this study expects green accounting to be legislated in the future, thus affecting the product production and increasing the operational cost, forcing enterprises to redesign their products. As few enterprises have voluntarily adopted green accounting, and since the guidelines vary in different countries, there are no statistics available at present to explore the magnitude of impact on product design. This study adopted the KJ (Kawakita Jiro) method for content analysis on “An Introduction to Environmental Accounting As A Business Management Tool” announced by the U.S. Environmental Protection Agency in 1995, the “Environmental Accounting Guidelines” released by the Ministry of Environment Japan in 2005 and the first version of the “Industrial Environmental Accounting Guidelines” drafted by the Environmental Protection Administration of Taiwan in 2008. The KJ method is a technique to group and organize different types of data and information, in order to comprehensively clarify the contents of seemingly unrelated events. The classification and integration processes can explore new meanings of events. It was developed by Japanese scholar, Kawakita Jiro [9]. This study extracted the additional expenditure, aside from the existing expenditure, from various guidelines and grouped the expenditures. The expenditure groups with similar attributes were clustered. The clusters were analyzed to determine the sample attributes of the clusters. Finally, the attributes were interpreted to summarize the factors that impact the product production and increase the cost. Then, meta-research was conducted for validation. Meta-research is used to re-study the primary research results and group a considerable amount of primary research together for further analysis, in order to find reliable results [10]. This study collected recent literature on green accounting and searched for empirical results and discourses on product production or operational cost for supporting the discussion results. Then, a discourse analysis was conducted to extend the correlation between the impact of product design and green design.

3.2. Research Process

Based on the three green accounting guidelines, this study extracted 86 items contributing to additional expenditures. Based on the KJ method, the 86 items were regarded as 86 units. Each unit was assigned one card, and the cards were grouped based on their cost attributes. From the large groups, the cards were further divided into smaller groups, until they could no longer be categorized. Finally, the cost units in each group were analyzed to identify the common characteristics or concepts and then named with the characteristic or concept. The items were not named before being clustered. As shown in Figure 1, the 86 cards were grouped based on the concepts, namely product and non-product. Then, in the product group, the cards were divided into product and R&D, and in the non-product group, the cards were divided into environmental requirements and social requirements. Finally, there were eight groups and one group that could be categorized. The next step was to identify an attribute or concept that is shared by all of the cards in the group. The attribute or concept should be the cause of additional expenditure.

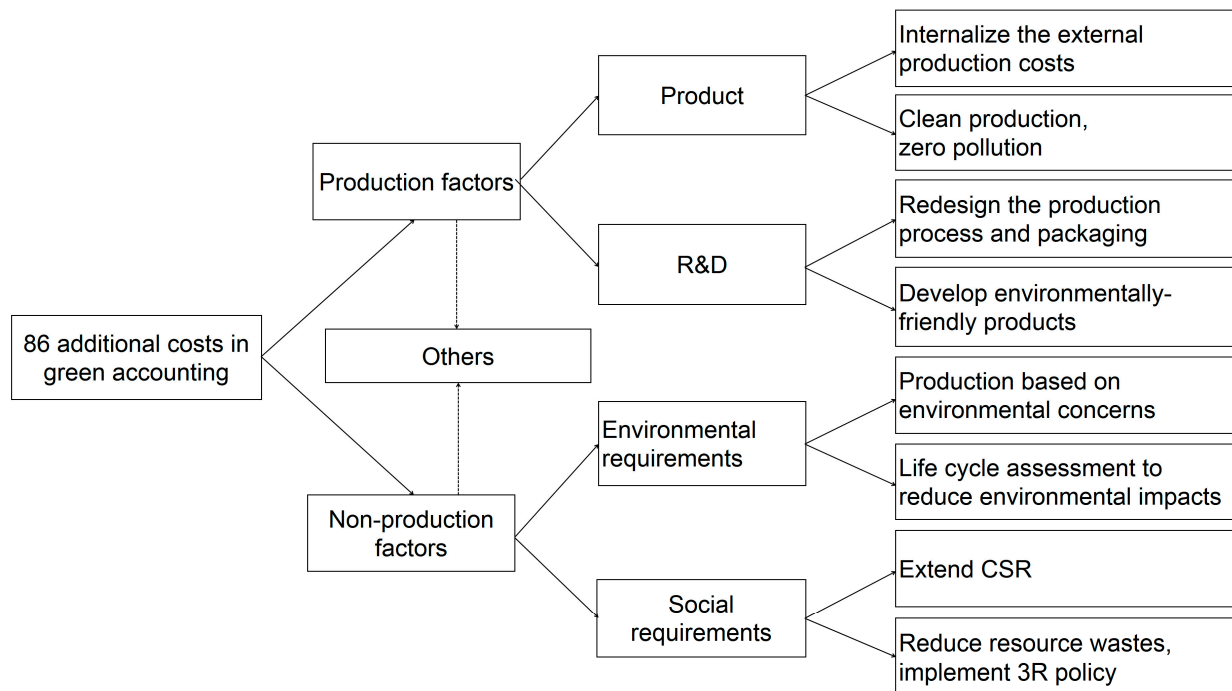


Figure 1. Diagram of factors have an effect (compiled by this study). CSR, corporate social responsibility.

For example, card No. 54 is the “cost of environmental recovery”. This additional expenditure is incurred because the product pollutes the environment, but has long been neglected by the manufacturer or is being handled by the government. Under green accounting, the manufacturer is responsible for the environmental pollution, and it is a problem of the product itself. This group contains seven other cards, including pollution control cost, waste fluid monitoring cost, waste management cost, penalty or compensation cost, environmental improvement cost, soil recovery cost and environmental settlement or compensation cost. The common attribute or concept of the eight cost units should be determined. The eight cost units are finally concluded as the costs for settling the environmental problems generated during the production process. They are costs outside of product production, but need to be paid by the manufacturer in green accounting. Thus, they are called the “internalize the external production cost”. Card 35 is “the cost of developing energy-saving production”. If this item is provided information by Material Flow Cost Accounting (MFCA) to improve and develop energy-saving production for the engineering department, another factor MFCA can be added. However, other factors can also contribute to developing energy-saving production. Thus, Card 35 can only be classified into “reduce resource wastes and implement 3R policy”, so as to make the factor simple and easy to understand. Card 49 is “research and development cost for producing products to protect the environment”, which is obviously the research and development project. On the other hand, without controversy, the products for environmental protection naturally include the factor of “developing environmentally-friendly products”. Card 50 is “the research and development cost of reducing environmental impact in production”, which is also the research and development project. Lifecycle assessment coefficient refers to the environmental impact assessment during the whole product lifecycle in terms of production, transportation, use and discard. Card 50 completely conforms to the concept of the factor “lifecycle assessment must be made for products to

reduce environmental impact.” The other factors are generalized similarly. The analytical results of the 86 cost units are listed in the Appendix. The factors include:

- (1) Internalize the external production costs: the enterprises should be responsible for the pollution that has been neglected or handled by the government.
- (2) Clean production, zero pollution: the product should not be harmful to the human body, nor produce pollution during the production process.
- (3) Redesign the production process and packaging: reduce the environmental impact during production and marketing.
- (4) Develop environmentally-friendly products: the production and disposal processes should not generate pollution.
- (5) Production based on environmental concerns: the production process that neglects pollution is not allowed.
- (6) Lifecycle assessment to reduce environmental impacts: assessment should be conducted during production, use and after use.
- (7) Extend CSR: the disposal of waste product should be extended from consumers to extended producer responsibility.
- (8) Reduce resource wastes, implement 3R policy: improve production efficiency and increase the reuse or recycling of resources.

4. Analysis and Discussion

Green accounting involves saving resources, green products, clean production and environmental production. This study explored the drivers behind the cost units and found that each factor contributes to the additional production or operational cost. Ding [2] investigated Taiwanese enterprises that have been certified with ISO14000 for environmental management from the financial aspect. For the 108 samples, their environmental performances had significant negative effects on the return on assets, return on equity and net operating profit. Similarly, Huang [11] explored whether implementing environmental management (ISO14000) could enhance corporate competitiveness and found that the correlation between corporate environmental performance and financial performance is unclear. Those empirical results indicated that environmental protection measures only bring additional costs to the enterprises, but not profits. However, green accounting is based on good faith for sustainable development of both the environment and the enterprises. It should not be given up due to the cost increase in the short term. Thus, many studies have attempted to help enterprises lower the costs, maintain existing profits or develop new technologies from the product design perspective, in order to enhance environmental performance. The previous findings are summarized as follows:

- (1) Green accounting will lead a more proactive environmental planning through the recognition and the reduction of environmental cost and, consequently, the improvement of the profitability of enterprises [12].
- (2) Based on public corporate environmental information, the review of corporate performance on the environment and society by construction of an environmental accounting system has become the trend. In the future, we should be devoted to R&D and try to improve environmental pollution [13].

- (3) In Australia, a study on large corporations found that the adoption of environmental accounting is positively correlated with process innovation; in other words, green accounting leads to new changes to the production process [14].
- (4) Properly-designed environmental standards can promote innovation, lower the total product cost, and enhance product value. Innovation can lead enterprises to use more productive raw materials, resources and labor, as well as reduce the cost incurred due to environmental improvement. By doing so, enterprises can enhance the resource productivity and competitiveness [15].
- (5) Green barriers can enhance the environmental performance of enterprises. Green barriers refer to the environmental requirement on product design, production, packaging and disposal, as mandated by the country of import on the importers [16].
- (6) Green innovation performances of the enterprises have a positive influence on corporate competitiveness. When the competitors have lower capability, green innovation yields higher positive influence on the corporate competitiveness [17].
- (7) Full control of environmental financial information can improve the production and design processes that are detrimental to environmental protection, thus reducing wastes, lowering environmental costs and avoiding risks [18].
- (8) Modern perspectives suggest that efficient resource utilization and reduction of wastes could save cost [19].
- (9) From the perspective of the resource-based view, new methods to reduce pollution include equipment operation, raw material recycling, product design and environmental awareness when creating market demands and lowering costs. This environmentally-oriented new thinking is based on end treatment. In other words, the concepts of lowering cost, increasing sales volume and reducing pollution should be incorporated in product design [20].
- (10) A study on 29 manufacturers that have implemented resource savings found that using technological innovation to increase resource productivity could offset environmental expenditure [21].

To sum up, the adoption of green accounting increases expenditure; thus, it is necessary to change product design in order to solve this dilemma. The need for change in product design is derived from impacts, which include using less resources to produce more products, the belief of reducing environmental cost by reducing pollution, using green innovation or environmental performance to enhance competitiveness, setting clean production as the goal for product design, using the material flow to calculate input and output to achieve equilibrium and achieving efficient production. The above are summarized as follows:

- (1) Less to produce more: more effective energy use and less waste output can reduce resource exhaustion. In other words, technological innovation can increase resource productivity and design more products with less raw material to reduce total cost.
- (2) Prevent pollution: shift from end treatment to pollution prevention; product design should be environmental oriented. The processing, production design and process going against environmental protection should be effectively improved. Saving can reduce waste.

- (3) Clean production: the basic requirements for green design are products without toxicity and production without pollution of the environment; for example, the EU has the requirement of three instructions of Directive on the Waste Electronics and Electrical Equipment (WEEE), Directive on the Restriction of Hazardous Substances (RoHS) and Energy-using Products (Eup) in antiviruses. Although clean production looks like a green barrier, nowadays, it is also the global consensus in carrying out environmental protection.
- (4) Reduce impacts: it is the requirement of green design; use lifecycle assessment to evaluate the environmental impact; design and employ recyclable and renewable resources; ignore exhausting the limited resources of the Earth; produce an impact on the Earth's ecological balance.
- (5) Environmental performance: improving processing design to make the environmentally external positive performance be greater than that of negative performance; showing environmental friendliness; increasing the corporate competitive advantage and environmental maintenance.
- (6) Input equals output: the production costs at every stage are analyzed and recorded by means of material flow cost accounting, from the cost of raw material to the system costs and the remaining and waste material cost, which are provided to engineering personnel as the basis for redesigning. It is required that the raw input equals the product output, trying best to make remaining and wasted material tend to zero.

Based on the above, the influences of green accounting on product design are illustrated in Figure 2.

Financial Accounting	Green Accounting
Supervision and guidance	Promotion and education
Ministry of Finance: National Taxation Bureau. Financial Supervisory Commission: Securities and Futures Bureau. GAAP GAAS Users of statement.	Environmental Protection Administration, Taiwan. Ministry of the Environment, Japan. US Environmental Protection Agency. International Federation of Accountants. (IFAC) UN Division for Sustainable Development.
↓ (Compelling)	↓ (Not compelling)
Financial information and statement	General disclosure statement of Green Accounting
↓ (Following of current laws)	↓ (Formation of laws and regulations)
1. Avoidance of corporate social responsibility. 2. Acquisition of maximum benefits of shareholders.	1. Internalization of external cost. 2. Reconsideration of product design .
↓ (Result)	↓ (Result)
1. Deteriorating environment. 2. Resource fighting of enterprises.	1. Economic sustainable development. 2. Sustainability of enterprises.

Figure 2. Impact of green accounting on product design (compiled by this study). GAAP: Generally Accepted Accounting Principles; GAAS: Generally Accepted Auditing Standards.

As seen, conventional financial accounting is based on the position of monitoring and supervision and imposes compulsory requirements on enterprises. However, enterprises only meet the minimum requirements, because their best interest is in maximizing shareholders' benefits. As a result, such practice leads to environmental deterioration. On the other hand, green accounting is only voluntary and has become the mainstream under the popular demand of CSR. It is foreseeable that green accounting will be legislated in many countries. If green accounting is mandated, all external costs of business activities will be internalized into environmental costs. Some enterprises even require the suppliers to improve the environment, thus increasing their expenditures. Those practices to ensure sustainable development of the economy should be based on the changes to the product design. In other words, when the operational costs of enterprises increase, the only solution is to change the product design. The core of green design is to "use less to produce more", "clean production", "green procurement", "product differentiation" and "efficient production" [8]. Although the implementation of green design is based on the ethical grounds of enterprises, the adoption of green accounting, whether implemented voluntarily by the enterprises to enhance environmental image and competitiveness or enforced compulsively by the governments in response to the sustainable development policy of the UN, will make green design the feasible solution to the dilemmas of green accounting.

5. Conclusions

- (1) The impact of green accounting on enterprises: Due to the CSR of enterprises, green accounting is the unavoidable trend. Production should not neglect environmental production and the production of low-cost and low-pollution products. Production and product design will be impacted. Based on the green accounting guidelines of the U.S., Japan and Taiwan, the results of the content analysis are as follows: (1) internalize the external production costs; (2) clean production, zero pollution; (3) redesign the production process and packaging; (4) develop environmentally-friendly products; (5) production based on environmental concerns; (6) lifecycle assessment to reduce environmental impacts; (7) extend CSR; and (8) reduce resource wastes and implement 3R policy. Thus, Factor 8 should be adopted as a measure of environmental awareness and pollution alleviation.
- (2) Efforts of green design in environmental protection: Green design has been developing for more than 30 years so far and has obtained positive affirmation in many studies, also including the quote in this paper. It has been the consensus around the whole world that green design is helpful for environmental protection. Based on the research results in recent years, six key points were concluded and sorted out in this study: (1) less to produce more; (2) prevent pollution; (3) clean production; (4) reduce impacts; (5) environmental performance; (6) input equals output; to prove that green design can produce benefits in enterprises, reduce environmental pollution and increase production efficiency.
- (3) The aspects of system and technology complement each other: Green accounting is the system aspect, that is the government makes policies about what enterprises should do. If enterprises implement green accounting completely in accordance with policies, it is inferred from the eight factors that many costs increase and the production technology is to be solved. In order to deal with the problem of energy savings plus production increasing and to prevent

environmental degradation, the technology aspect needs to be deal with. During the process of corporate business activities, green design can provide technology support for dealing with the negative externalities problem. The method of innovative technology can also increase the resource productivity. It is suggested in the study: if enterprises are willing or are required by the government to implement green accounting in the future, a green design method can be adopted. It can deal with the problem of energy savings plus production increasing. In addition, it can achieve the goal that has been recognized of green design in preventing environment deterioration and maintaining sustainable corporate operation.

Author Contributions

In this article, research was done by Huang Hsieh-Shan under the guidance of Jui-Che Tu. Jui-Che Tu provided the theme direction, and the researcher then collected and analyzed the data. All results or changes had to go through the guidance of the professor. The article was written by the researcher. Both authors have read and approved the final manuscript.

Appendix

Table A1. Additional costs arising from green accounting and categorization.

Country	Content	Factor
A	1. Monitoring or testing cost is required by law.	5
	2. Research or simulation cost is required by law.	3
	3. Planning cost is required by law.	3
	4. Training cost is required by law.	0
	5. Testing cost is required by law.	5
	6. Environmental insurance cost is required by law.	2
	7. Pollution control cost is required by law.	1
	8. Waste fluid detection cost is required by law.	1
	9. Waste management cost is required by law.	1
	10. Environmental tax is required by law.	5
	11. R&D cost in the initial stage	3
	12. Retirement or closing cost when discarded	2
	13. Recovery cost after closing	2
	14. Voluntary addition of cost to strength community relations	7
	15. Voluntary addition of cost to strength monitoring or testing	5
	16. Voluntary addition of cost to increase auditing or training	0
	17. Voluntary addition of cost to find green suppliers	6
	18. Voluntary addition of cost to make improvements	5
	19. Voluntary addition of cost to strengthen recycling	8
	20. Voluntary R&D cost	3
	21. Cost to establish environmental groups or research institutes	5
	22. Cost to follow new regulations	0
	23. Loss from damaging natural resources	0
	24. Cost of maintaining corporate image	7
	25. Penalty or compensation cost	1

Table A1. Cont.

Country	Content	Factor
J	26. Cost to prevent air pollution	5
	27. Cost to prevent water pollution	5
	28. Cost to prevent soil pollution	5
	29. Cost to prevent noise pollution	5
	30. Cost to prevent vibration pollution	5
	31. Cost to prevent ozone pollution	5
	32. Cost to prevent land subsidence	5
	33. Cost to prevent other pollutions	0
	34. Cost to prevent global warming	7
	35. Cost to develop energy-saving production	8
	36. Cost to effectively use resources	8
	37. Cost to recycle industrial wastes	2
	38. Cost to dispose industrial wastes	2
	39. Cost to supplement recycling	8
	40. Additional cost for adopting green procurement	6
	41. Additional cost for producing environmentally-friendly products	4
	42. Additional cost for reducing packaging	4
	43. Cost of recycling discarded products	8
	44. Cost of disposing discarded products	8
	45. Cost to maintain environmental management	5
	46. Cost to monitor environmental impacts	5
	47. Cost to provide employee training on environmental management	2
	48. Cost of environmental improvement activities	7
	49. R&D cost on environmentally-friendly products	4
	50. R&D cost on reducing environmental impacts during production	6
	51. R&D cost on reducing environmental impacts during marketing	6
	52. Donations to environmental groups	7
	53. Donations to support community environmental activities	7
	54. Cost of environmental recovery	1
	55. Litigation cost on environmental protection	0
	56. Environmental insurance cost	2
T	57. Cost of air pollution prevention	5
	58. Water pollution prevention	5
	59. Soil and groundwater pollution prevention	5
	60. Noise pollution prevention	5
	61. Vibration pollution prevention	5
	62. Odor pollution prevention	5
	63. Land subsidence prevention	5
	64. Climate change prevention	7
	65. Ozone damage prevention	7
	66. Effective use of resources	8
	67. Reduce and recycle general wastes	8
	68. Reduce and recycle hazardous wastes	8

Table A1. Cont.

Country	Content	Factor
T	69. Treatment and final disposal of general wastes	8
	70. Treatment and final disposal of hazardous wastes	8
	71. Additional cost of procuring raw materials with low environmental impact	6
	72. Cost of 3R and modification for product	8
	73. Cost of 3R and modification for container and packaging	8
	74. Cost of environmental education	0
	75. Cost of implementation and maintenance of environmental management system	5
	76. Cost of environmental monitoring	5
	77. R&D of products with low environmental impact	6
	78. R&D of production process with low environmental impact	6
	79. R&D of sales method with low environmental impact	6
	80. Cost of improving external environment	1
	81. Donations to environmental protection	7
	82. Cost of soil recovery	1
	83. Insurance cost on environmental protection	2
	84. Settlement or compensation cost on environmental disputes	1
	85. Penalty and litigation cost on environmental matters	0
	86. Energy tax	5

Note: A: U.S., J: Japan, T: Taiwan. Source: compiled by this study.

Refining process:

The first step is to determine whether this cost unit has an impact on production and operation. Is it a direct impact (product itself) or an indirect impact (additional cost to the enterprise)? What are the impacts and to what degree? The second step is to consider the preventive cost for the product and production process. The third step is to consider the cost incurred during the production or marketing process to reduce, prevent or eliminate the environmental impacts due to the business activities, for the purpose of effective utilization of resources. Finally, eight groups are generalized.

Reason for categorization and ratio:

Product, 18.6%

- (1). Internalize the external production costs: eight items, 9.3%
- (2). Clean production, zero pollution: eight items, 9.3%

R&D, 8.1%

- (3). Redesign the production process and packaging: four items, 4.6%
- (4). Develop environmentally-friendly products: three items, 3.5%

Environmental requirements, 38.4%

- (5). Production based on environmental concerns: 25 items, 29.1%
- (6). Lifecycle assessment to reduce environmental impacts: eight items, 9.3%

Social requirements, 25.6%

- (7). Extend CSR: nine items, 10.5%
- (8). Reduce resource wastes, implement 3R policy: 13 items, 15.1%

Others, 9.3%

(9). Irrelevant to production or operation: eight items, 9.3%

Conflicts of Interest

The authors declare no conflict of interest.

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