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Assessing the SMEs' Competitive Strategies on the Impact of Environmental Factors: A Quantitative SWOT Analysis Application

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1. Introduction

In today's highly competitive environment, strategic management has been widely used by all enterprises to withstand fierce competition. Environmental management has quickly emerged as an essential strategic factor in many industries. Environmental considerations are clearly becoming increasingly important and will be considered as one of the key factors in most companies' success stories. For example, recently there are many firms in Asia that had already received ISO 14001 certification and adopted these Environmental Management Systems (EMS) standards as their state policy. No doubt that many firms have recognized the compatibility between environmental performance and profitability, as it witnessed by increasing interest in recycling programs and green marketing, in part due to realizing that the futility of running from such pressures.

Melnyk et al. (2003) apply a survey of North American managers to demonstrate that firms having gone through EMS certification experience a greater impact on performance than do firms that have not certified their EMS. Pan (2003) applies questionnaires to the organizations within Taiwan, Japan, Hong Kong and Korea on regards of ISO9000 and ISO14000 issues. He uses statistical analysis results of the survey data to gain eight common points for ISO9000 and ISO14000 certified firm within these four countries. Tan et al. (2003) develop an e-commerce structure for sorting, selecting and utilizing information for the effect of ISO9000 system. The related studies of environmental issues will be listed in Environment Management (Ahsen and Funck, 2001; Rao et al., 2006; Gernuks et al., 2007), Environmental Management Accounting (Jasch, 2003), ISO14001 Certification (Fryxell and Szteo, 2002; Mbohwa and Fukada, 2002; Rennings et al., 2006) and Life Cycle Assessment for EMS (Zobel, 2002).

In a country's endeavor to implement EMS in both manufacturing and service sectors, the significance of Small and Medium Enterprises (SMEs) deserves special attention. In Taiwan, a SME is set under either two conditions. First, it is defined by the number of employees that they often refer to those with less than 200 employees involved in manufacturing, building and mining industries. Second, it is defined by its capital volume that is less than 80 million Taiwan dollars. The SMEs are typically much smaller in operation compared to the global and multinational enterprises, whereas most of the SEMs in Taiwan are positioned in the ending-role of the supply chain. Most EMSs in Taiwanese SMEs are implemented in

accordance to specification in ISO 14001 or QC080000 standards, in which contain requirements that have to be fulfilled before third-party certification and /or registration can be achieved.

Strength, Weakness, Opportunity and Threat (SWOT) analysis is an important support tool for decision-making, and is commonly used as a means to systematically analyze an organization's internal management capability and its external environment. The purpose of the analysis on internal strengths and weaknesses is to assess how an enterprise carries out its internal work, such as R&D, day to day business operation, etc. On the other hand, the purpose of the analysis on the external opportunities and threats is to assess whether or not an enterprise can seize opportunities and avoid threats, whilst facing an uncontrollable external environment, such as fluctuating prices, political destabilization, etc. SWOT analysis has been successfully applied in EMS fields, such as the environmental impact assessment in India (Paliwal, 2006), the development of an environmental management system (Lozano and Vallés, 2007) and regional energy planning for renewable development (Terrados et al., 2007).

For a quantitative SWOT, Kuttila et al. (2000) develop a hybrid method, the Analysis Hierarchy Process (AHP) in the SWOT analysis, to eliminate the weakness in the measurement and evaluation steps of the SWOT analysis. Examples in literature of studies that follow the method of Kuttila et al. include those by Kajanus et al. (2004), Leskinen et al. (2006) and Chang and Huang (2006). Yüksel and Dağdeviren (2007) demonstrate a process for quantitative SWOT analysis that can be performed even when there is dependence among strategic factors. They use the Analytic Network Process (ANP) that allows measurement of the dependency among the strategic factors as well as its AHP, which is based on independence between the factors. ANP is a more general form of its predecessor, the AHP, for ranking alternatives based on some set of criteria. Unlike AHP however, ANP is capable of handling feedbacks and interdependencies, which exist, in complex systems like a manufacturing system. ANP problem formulation starts by modeling the problem that depicts the dependence and influences of the factors involved to the goal or higher-level performance objectives. Dependence among the SWOT factors is observed to effect the strategic and sub-factor weights, as well as to change the strategy priorities. Dyson (2004) provides an SWOT and TOWS analysis to create strategy formation and its incorporation into the strategic development process at University of Warwick by scoring SWOT factors. A variation of SWOT analysis is the TOWS matrix. In the TOWS matrix the various factors are identified and these are then paired e.g. an opportunity with a strength, with the intention of stimulating a new strategic initiatives (Table 1).

A "top-down" way of thinking could be used to guide the formulation of decision hierarchy. In this paper, a new quantitative SWOT analysis is provided that allows measurement of the strategic factors as well as its vote-ranking method. The first task is to invite eighteen certificated ISO9000 and ISO14000 auditors (or lead auditors) to organize a "Task Force (TF)". The TF will discuss SWOT of Taiwanese SMEs within their EMS issues and assess the competitive strategies. The second task is to apply the internal competitive strengths to find external market opportunities. As a result, the strategy combination for max {strengths, opportunities} and min {weaknesses, threats} will be provided. The third task is to regard these SWOT indexes and their sub-criteria as the candidates voted by the task force. In conclusion, the different results of ranking will expose different weights among the votes of the candidates.

This paper discusses the environmental issues of the SMEs not only by drawing insights from research conducted in different countries, but also look into the use of environmental

factors of SWOT through their development, their context and adaptability to enhance the environment performance of SMEs. As for the medium, the vote-ranking method will be used to rank the different competitive strategies and priorities. This specific method provides a new quantitative SWOT methodology that will be extended to decision-making issues. The rest of this paper is organized as follows: Section 2 illustrates the vote-ranking method and the conceptual approach. Section 3 discloses the use of vote-ranking method to provide a quantitative SWOT method for assessing the SMEs' competitive strategies in EMS by six-step procedure. Section 4 discusses the results of different strategies and suggestions. Section 5 highlights some conclusions and offers directions for further researches.

2. Vote-ranking methodology

Data Envelopment Analysis (DEA) is an analytical procedure developed by Charnes et al. (1978) for measuring the relative efficiency of decision-making units (DMUs) that perform the same types of functions and have identical goals and objectives. The weights used for each DMU are those which maximize the ratio between the weighted output and weighted input. DEA is a mathematical programming technique that calculates the relative efficiencies of multiple DMUs, based on multiple inputs and outputs. A well-known method for ranking candidates in a ranked voting system is to compare the weighted sum of their votes after determining suitable weights. Cook and Kress (1990, 1992) present an approach to the problem of ranking candidates in a preferential election. They consider an alternative method which does not specify the sequence of weights by applying DEA. One would imagine that any reasonable person, voter, candidate or poll manager would agree that the first place votes should weigh at least as much as second place votes, and so on. They provide the following DEA model to obtain the total score for each candidate:

$$
\begin{aligned}
& Z_{rr}(\varepsilon) = \max \sum_{s=1}^{S} u_{rs} x_{rs} \\
& s.t. \quad Z_{rq}(\varepsilon) = \sum_{s=1}^{S} u_{rs} x_{qs} \le 1, \quad q = 1,2,...,R; \\
& \qquad u_{rs} - u_{r(s+1)} \ge d(s,\varepsilon), \quad s = 1,2,...,S-1; \\
& \qquad u_{rS} \ge d(s,\varepsilon).
\end{aligned}
\tag{1}
$$

Where,
s: the number of places, s =1, … , S.
r: the number of candidates, r =1, … , R.
u_{rs}: the weights of the sth place with respect to the rth candidate.
x_{rs}: the total votes of the rth candidate for the sth place.
d(s, ε): the given difference in weights between sth place with (s+1)th place; d(., ε), called the discrimination intensity function, is nonnegative and non-decreasing in ε. Parameter ε is nonnegative.
The Cook and Kress's ranked voting model (1) is assumed that in a voting system, each voter selects R candidates and ranks them from the 1st to the Sth places, $S \le R$. The d(s, ε) is to ensure that first place votes are valued at least as highly as second place votes which are valued at least as highly as third place votes etc. The Z_{rq} is the cross-efficiency which can be thought of here as candidate r's evaluation of candidate q's desirability. The constraints Z_{rq}

are the usual DEA constraints i.e. that no candidate q should have a desirability greater than 1 under r's weights. The Z_{rr} has been used in the objective function to emphasize the candidate r's evaluation of his/her own desirability. The rth candidate wishes to be assigned the weight u_{rs} so as to maximize the weighted sum of votes to candidate r, that is when the score Z_{rr} becomes the largest. Notionally, each candidate was permitted to choose the most favorable weights to be applied to his/her standings in the normal DEA manner, with the additional 'assurance region' restriction, in which the weight for a sth place vote should be greater than the one for a (s+1)th place vote by some amount. Hashimoto and Ishikawa (1993) consider the candidates in ranked voting systems as the DMUs in DEA, and each is considered to have many outputs and only one input with unity. He also deems that it is fair to evaluate each candidate in terms of the weights optimal to himself/ herself.

Green et al. (1996) further develop this model by setting certain constraints to the weights. They point out that the form of d(s, ε) affects the ranking results and does not allow DMUs to choose their own weights unreservedly. Therefore, they present an alternative procedure that involved using each candidate's rating of him/herself along with each candidate's rating of all the other candidates. They utilize the cross-efficiency model to DEA to obtain the best candidate. On the other hand, Hashimoto (1997) proposes a method to determine a total ordering of candidates specifying nothing arbitrary, but only assuming the condition of decreasing and convex sequence of weights. They incorporate the condition of decreasing and convex sequence of weights into DEA as the assurance region. Green et al. and Hashimoto proposes these methods, whereabouts the existence of low preference candidates may change the ranks and DEA exclusion model, which seems to be unstable with respect to the inefficient candidates. Obata and Ishii (2003) consider that, the instability is caused by the fact mentioned above and that the inefficient candidates should not be used to discriminate efficient candidates. They also use this information only on efficient candidate while discriminating and realizing that the order of efficient candidates never changes even though the inefficient candidates are added or removed. Foroughi and Tamiz (2005) simplify the model of Obata and Ishii and extend it to rank the inefficient candidates as well as the efficient one.

Noguchi et al. (2002) revise the application of Green's method and show that different weights among objects gave rise to different ranking results. If one wants to set particular constraints to a weight can be employed, which is characterized by the following constraints: (a) $u_{r1} \geq 2\ u_{r2} \geq 3\ u_{r3} \ldots \geq S\ u_{rS}$, (b) $u_{rs} \geq 1/[(1+2+\ldots+S)*n] = 2/(n*S(S+1))$, where n is the number of voters. In this multiple criteria case, the vote-ranking model is defined as follows:

$$
\begin{aligned}
& Z_{rr} = \max \sum_{s=1}^{S} u_{rs} x_{rs} \\
& s.t. \quad Z_{rq} = \sum_{s=1}^{S} u_{rs} x_{qs} \leq 1 \qquad q = 1,2,\ldots,R; \\
& \qquad s u_{rs} \geq (s+1) u_{r(s+1)}, \qquad s = 1,\ldots,(S-1); \\
& \qquad u_{rS} \geq \frac{1}{\left[(1+2+\ldots+S)n\right]} = \frac{2}{n*S(1+S)}.
\end{aligned}
\tag{2}
$$

Where, these variables are the identical as model (1).

As for ranking of alternatives, one of the most popular methods compares the weighted sum of votes after determining suitable weights for each alternative. The different weights among objects resulted in different ranking results and propose a new method of ordering in order to solve the problem of weights ranking. As a final point, the module solver imbedded in EXCEL of Microsoft Office [2003] will be applied to solve the above linear programming problems (Liu and Hai, 2005).

3. The competitive strategies of the Taiwanese SMEs for EMS

This study proposes six-step procedure for selecting the competitive strategies of the Taiwanese SMEs. They are obtained from TF which will fall into four subjective criteria that discuss and analyze SWOT of Taiwan's SMEs in the EMS. The first step is structuring the problem into a SWOT hierarchy. On the top level is the overall goal of selection competitive strategies. On the second level are the four SWOT criteria that contribute to the overall goal. The criteria (sub-criteria) for strengths (S1, S2, S3), opportunities (O1, O2, O3), weaknesses (W1, W2, W3) and threats (T1, T2, T3) are individually presented into Level 2 and 3. On the second level is that four criteria are decomposed into twelve sub-criteria under SWOT; additionally on the bottom (or fourth) level, there are five alternative competitive strategies that are to be evaluated in terms of the sub-criteria listed on the third level. These competitive strategies (OS-1, OS-2, OW-1, TS-1 and TW-1) are assessed in Level 4 and illustrated in Fig.1.

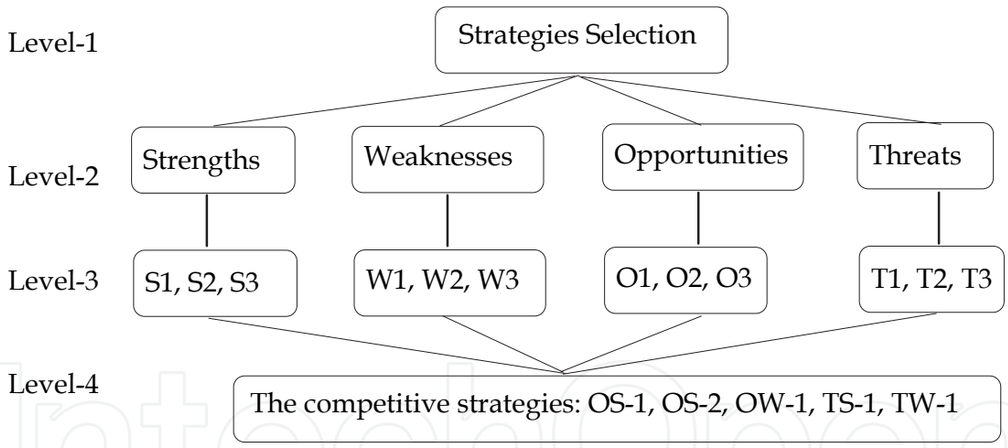

Fig. 1. A SWOT hierarchy for selecting the competitive strategies

3.1 Step 1: SWOT analysis

First of all, the author invites the eighteen certificated ISO9000 or ISO14000 auditors (or lead auditors), consists of 14 part-time and 4 full-time auditors, to organize a TF in this particular study. They are first briefed about the overall objective of the study, then specifically on the SWOT and vote-ranking methodologies. The questionnaires are used for interviewing purposes; however they mainly use a board or group decision method to determine the criteria and sub-criteria for selecting the competitive strategies. The study is to apply the internal competitive strengths to find external market opportunities. This is followed by the analysis on the organization's external competitive environment and internal operating environment. Consequently, the internal analysis is followed by the selection and

implementation of strategies. Due to highly global nature of the "Green House", the requirements of EMS are also applicable for other countries in the European Union. For selecting the competitive strategies of SMEs for EMS, the TF has been mainly on the discussion of the SWOT method and problem defining after a series of revision. The strategy combination of EMS for max {strengths, opportunities} and min {weaknesses, threats}, OS-1, OS-2, OW-1, TS-1 and TW-1, is provided in Table 1.

	Strengths: +S1: Capability to execute and develop EMS certification +S2: Synergy with commerce, environmental protection and education units +S3: Possessing high level of environmental education	**Weaknesses:** -W1: SMEs respond slowly and difficultly for external customer requirements -W2: Some suppliers or manufacturers are unwilling to face higher environmental regulation required and seek other markets with lower quality consciousness -W3: The government's regulations of environmental protection are too loose
Opportunities: +O1: Change in customers' preferences (increase in market demand for EMS or QMS certification) +O2: Increase value-added of product +O3: Improvement in Green House and in environment	**Maxi-maxi (O-S) Strategies** OS-1: Extend EMS Certification effects to create high value-added markets OS-2: Involve in improving environment issues and promote company image and profits	**Maxi-mini (O-W) Strategies** OW-1:Change directly in manufacture preferences to create products of high environmental requirement standard
Threats: -T1: Diminishing specific market demand and profitability -T2: Government or industry restrictive practices -T3: Negative corporation image if EMS certification is abandoned	**Mini-maxi (T-S) Strategies** TS-1: Increase strictly government or industry environmental regular	**Mini-mini (T-W) Strategies** TW-1: Government impel environmental education and assistance for SMEs

Table 1. SWOT and TOWS matrixes for EMS

3.2 Step 2: priority votes of criteria and sub- criteria in SWOT

The second task is to regard these SWOT indexes as candidates that are voted by TF. The four criteria are the strength, weakness, opportunity and threat indexes and the twelve sub-criteria are S1-3, W1-3, O1-3 and T1-3 alternatively, within the SWOT. They are regarded as the selected items and expected to receive votes with respect to the related elements within the model, as shown in Table 1.

The TF illustrate the order for the four criteria and the votes for each which are shown in Table 2. Every members will vote from 1 to S, ($S \leq R$), where R is the number of criteria or sub-criteria. They are regarded as candidates whom are to be voted by different places. Afterward, TF will list its priority votes of sub-criteria in fixed first criterion within Table 3. They were only asked to determine the order of the criteria or sub-criteria, however not the weight of each criterion or sub-criterion.

Criteria	1st	2nd	3rd	4th	Weights
Strengths	4	8	4	2	0.264
Opportunities	7	4	7	0	0.299
Weaknesses	2	0	7	9	0.174
Threats	5	6	0	7	0.263

* *The weights are normalized and totally equal to one.*

Table 2. Priority votes of four criteria

3.3 Step 3: calculate the weights of criteria and sub- criteria in SWOT

The votes on Table 2 are used to calculate the weights of the four criteria by model (2), R=4, S=4, n=18 and the lowest weights of the fourth place are $\frac{1}{180}$ ($u_{r4} \geq 2/\ [n*S(S+1)] = 2/\ [18*4(5) = 0.0056]$). The weights for strength, weakness, opportunity and threat at the second level are 0.884, 1.000, 0.581 and 0.882, respectively. After normalizing these data, the weights of outcome are 0.264, 0.299, 0.174 and 0.263, as it is illustrated in column 6 of Table 2, respectively. For "Strengths" in the Table 3, there are variables R=3, S=3, n=18 and the lowest weights of the third place are 1/108 ($u_{r3} \geq 2/\ [n*S(S+1)] = 2/\ [18*3(4) = 0.0093]$). Similarly, the votes within Table 3 are using the same procedure in order to determine the weights of the sub-criteria. The results of the weight of sub-criteria are listed in columns 5 and 10 of Table 3.

Criteria	Votes			Weights		Votes			Weights
	1st	2nd	3rd			1st	2nd	3rd	
Strengths					Opportunities				
S1	13	4	1	0.465	O1	15	2	1	0.495
S2	0	9	9	0.227	O2	0	15	3	0.258
S3	5	5	8	0.308	O3	3	1	14	0.247
Total	18	18	18		Total	18	18	18	
Weaknesses					Threats				
W1	11	7	0	0.439	T1	5	5	8	0.304
W2	3	3	12	0.258	T2	5	9	4	0.336
W3	4	8	6	0.303	T3	8	4	6	0.360
Total	18	18	18		Total	18	18	18	

* *The weights are normalized and totally equal to one.*

Table 3. Priority votes and weights of twelve sub-criteria

3.4 Step 4: scores of competitive strategies in SWOT

The competitive strategies, OS-1, OS-2, OW-1, TS-1 and TW-1 are subjective indices that could be translated into numerical ratings using different methods, such as questionnaire, AHP or vote-ranking and so much more. TF may ask their colleagues to answer these questionnaires in order to rate the competitive strategies of sub-criteria of each SWOT. A major problem was thus, to ensure the consistency between managers and to avoid any bias creeping in. A set of standard guidelines was placed after discussions with the TF (voters). It is mainly agreed that all performance scores would be based on a nine points grade scale.

Each grade would have an adjective descriptor and an associated point score or range of point scores. The TF makes their judgment on the qualitative scale of adjectival descriptors. Table 4 lists the example for rating the strength and opportunity indices, where the lower and upper scores are predetermined from 1-9. The strength and opportunity indices should be maximized, the least-favorable candidate is assigned the smallest value and the most-favorable candidate is assigned the largest value. On the other hand, the weakness and threat indices need to be minimized, where the least-favorable candidate is assigned the largest value and the most-favorable candidate is assigned the smallest value. The overcoming range of subjective indices is set between 1 and 9 illustrated in Table 5. Therefore, each of the competitive strategy can be awarded a 'score' from 1 to 9 on each sub-criterion.

Scores	Rules
9	Greatly conforming to market and sub-criteria of requirement, successful probability more than 90%
7	Better conforming to market and sub-criteria of requirement, successful probability about 70%
5	Conforming to market and sub-criteria of requirement, successful probability about 50%
3	Slightly conforming to market and sub-criteria of requirement, successful probability about 30%
1	Not conforming to market and sub-criteria of requirement, successful probability about 10%

Table 4. Grading different strategy scores in strength and opportunity indexes

Scores	Rules
9	Greatly overcoming sub-criteria requirement, successful probability more than 90%
7	Better overcoming sub-criteria requirement, successful probability about 70%
5	Exactly overcoming sub-criteria requirement, successful probability about 50%
3	Slightly overcoming sub-criteria requirement, successful probability about 30%
1	Not overcoming sub-criteria requirement, successful probability about 10%

Table 5. Grading different strategy scores in weakness and threat indexes

The five competitive strategies, OS-1, OS-2, OW-1, TS-1 and TW-1, by means of the highest rating were regarded as the best competitive strategies, with the rest being ranked accordingly. The competitive strategies will earn the average scores of questionnaires within Table 4 and Table 5 by TF. The average of collected scores is listed in the columns 5-9 of Table 6.

3.5 Step 5: total weighted scores of competitive strategies

This step requires the TF to assess the performance of all the competitive strategies within the twelve sub-criteria of SWOT identified as important for competitive strategies rating. Simple score sheets were provided to assist the manager to record the scores for each strategy on each of the twelve sub-criteria. An example of this strategy is shown in Table 6. In the first row of Table 6, the number 0.123 is equal to the product of the "Strength" criterion score 0.264 multiply with the S1 given value of "0.465". Moreover, the same method is applied to obtain

other results. Once the weights for sub-criteria have been determined, it is relatively easy to calculate the resulting competitive strategies rating scores.

Mathematically, the rating is equivalent to the sum of the product of each sub-criterion weight and the competitive strategy performance score. The rating value of competitive strategies is obtained by summing the products of the respective elements. The competitive strategies rating value for strategy OS-1 is obtained by summing up the products of the respective elements in columns 4 and 5 for each row; given in the final column 10, the over all total weighted scores of the row is "6.859". The rating method used in strategy OS-1, can be used to find the total scores of the other four strategies stated in columns 11-14 of Table 6. The rating value for each competitive strategy is obtained by summing the products of the respective elements in the matrix; given in the final score, the values of over all competitive strategies of OS-1, OS-2, OW-1, TS-1 and TW-1 respectively is, 6.859, 8.357, 7.532, 7.298 and 8.274 stated within the last row of Table 6. This gave a rating score for each competitive strategy, whereas the higher the rating, the better the overall performance for competitive strategy.

3.6 Step 6: assessment of competitive strategies

In the last row of Table 6, the rating value for each strategy is obtained; the final score and the ranking of competitive strategies for OS-2, TW-1, OW-1, TS-1 and OS-1 is first, second, third, fourth and fifth respectively. Even though the score of OS-2 is only higher by 0.083 than TW-1 and the score of OW-1 is higher by 0.234 than TS-1, however for both of the competitive strategies, the difference of scores will definitely change the overall final rank. These results will be regarded as sensitivity analysis for five competitive strategies.

Criteria	Sub-criteria		Weights	Grade Strategies Scores					Weighted Strategies Scores				
(A)	(B)		(C= A×B)	OS-1	OS-2	OW-1	TS-1	TW-1	OS-1	OS-2	OW-1	TS-1	TW-1
Strengths	S1	**0.465**	**0.123**	6.833	8.889	8.056	6.944	8.722	0.839	1.091	0.989	0.853	1.071
0.264	S2	0.227	0.060	6.944	8.944	7.611	7.278	8.500	0.416	0.536	0.456	0.436	0.509
	S3	0.308	0.081	7.056	8.833	7.556	8.611	8.611	0.574	0.718	0.614	0.700	0.700
Opportunities	O1	0.495	0.148	6.833	7.778	7.389	7.278	8.167	1.011	1.151	1.094	1.077	1.209
0.299	O2	0.258	0.077	6.944	8.000	7.611	7.389	8.000	0.536	0.617	0.587	0.570	0.617
	O3	0.247	0.074	6.778	8.111	7.778	7.500	7.944	0.501	0.599	0.574	0.554	0.587
Weaknesses	W1	0.439	0.076	6.611	7.778	7.222	6.944	7.833	0.505	0.594	0.552	0.530	0.598
0.174	W2	0.258	0.045	6.500	7.833	7.278	7.056	7.778	0.292	0.352	0.327	0.317	0.349
	W3	0.303	0.053	6.667	7.944	7.500	7.278	7.722	0.351	0.419	0.395	0.384	0.407
Threats	T1	0.304	0.080	7.056	8.611	7.278	7.000	8.444	0.564	0.688	0.582	0.560	0.675
0.263	T2	0.336	0.088	7.111	8.722	7.556	7.167	8.389	0.628	0.771	0.668	0.633	0.741
	T3	0.360	0.095	6.778	8.667	7.333	7.222	8.556	0.642	0.821	0.694	0.684	0.810
Total Weighted Scores									6.859	8.357	7.532	7.298	8.274

Table 6. The SWOT analysis of different strategies

4. Discussion

First of all, considering that the strategy OS-1 has the lowest score within the strategy analysis, most of the SMEs supposed that this strategy is quite acceptable even though there

are still have some doubts present, especially on whether or not by obtaining the EMS related international standard authentication, such as ISO14000, it will certainly create a high value-added market. From a present market condition which is quite unfeasible to reflect the practical demand, frequently as a final result it is invested in fund or modification. Even though most of the customers are quite optimistic and agreed to this way of doing, however when everything is fully involved within EMS in the future, it will certainly has some affect on its capital or product selling price. Which means that at the present moment, the demand on this particular product is lacking, furthermore, it might resulted in the incapability to agree on these certain analysis by some SMEs.

Moreover, from the strategy analysis OW-1and TS-1 point of view, direct changes in manufacture preferences to create products of high environmental requirement standard has a bigger risk toward the SMEs in term of direct investment. Generally, average companies do not have certain investment planning until it has reached a deal, order placement or customer's promise in advance. Additionally, an increasingly strict government or industry environmental in carrying out this phase is facing difficulty, where presently the government mostly is using counseling method or fund assistance to encourage and urge the industry to increase its EMS ability in order to reach the low price product strategy and high level of product diversification.

Lastly, the strategy OS-2 imposes a similar way of thinking with strategy TW-1. Taiwanese SMEs apperceive the significance of EMS and also recognize the importance to survive within the diversified competing market environment, whereas they need to build up its environmental management that has to suit the EMS specification and attention. However, the investment within environmental protection for its resources and facilities requires a great amount of expenditures. Under this major investment, if the expected outcomes are unpredictable, therefore the willingness on investing within the environmental management will suffer an enormous drawback. These SMEs certainly would hope that government will work together with country resources, providing some assistance in procuring EMS needed facilities and equipments or even any related training within the environmental management scope, moreover guidance or counselling in obtaining different kinds of ISO authentic certificate will also be valuable resource.

Obviously, most people are familiar with the conflicts between environmental protection and economic development. Those who are convinced of the consequences of global warming will remain convinced, while those suspicious will remain suspicious. After all, economic development means bread, while the mankind cannot immediately appreciate the deep implications of its damage to the great nature. Therefore, politicians should be aware of the environmental implications of legal provisions and regulations. Likewise, the industry authorities, when developing new products, should consider the intangible social cost of pollution as a part of the overall cost and deal with the issue of pollution as a part of life cycle management, so that such considerations and practices will benefit our earth. In EMS, this will further our understanding of the potential poisonous substances to be produced in production, deployment and replacement stages, and will help us minimize pollution and thus contribute to environmental protection.

5. Conclusions

With the continuing development of human civilization and technology, the life cycle of any products, from production, consumption to final waste, it is involving more and more external adverse factors which bring about direct or indirect impact on the environment.

Economists said that we should stop aggravation of global warming now; and there is only one earth; therefore, be environmentally friendly.

Lastly, the competitive strategies OS-2 and TW-1 will be provided to Taiwanese SME department and industry union. The main contributions of this study are as follows:

1. The selection procedure of competitive strategies in SWOT can assist the audience to think in a very comprehensive and detailed manner, while allowing them to categorize various issues.
2. In this field, many researchers have sought to improve the different capabilities of quantitative SWOT, such as AHP, ANP or fully rank decision-making units. In this case, the vote-ranking methodology incorporated with SWOT is applied and as a result, it became the easiest and most convenient method compared to others.

The vote-ranking is presented as an approach to the problem of ranking candidates in a preferential election. The future researches had suggested that the cross-evaluation method is better off to be applied to assess candidates through peer-group, whereas one can attain a more balanced view of the weight-setting. The cross evaluation can be used to overcome the problem of maverick decision-makers. The proposed methodology can be utilized to issues of SWOT, such as AHP or ANP within this study.

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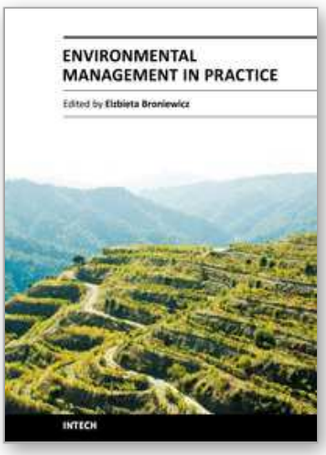

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In recent years the topic of environmental management has become very common. In sustainable development conditions, central and local governments much more often notice the need of acting in ways that diminish negative impact on environment. Environmental management may take place on many different levels - starting from global level, e.g. climate changes, through national and regional level (environmental policy) and ending on micro level. This publication shows many examples of environmental management. The diversity of presented aspects within environmental management and approaching the subject from the perspective of various countries contributes greatly to the development of environmental management field of research.

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