Strategies for SMEs based on a PEST-SWOT-AHP Analysis in Response to the Introduction of the Product Liability Law

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**Abstract.** To formulate strategies for small and medium-sized manufacturing enterprises (SMEs) in response to the enforcement of the product liability (PL) law, factors that influence the enforcement of the PL law were identified through a political, economic, social, and technological (PEST) analysis. Furthermore, the relative importance was proposed for each area through a strengths, weaknesses, opportunities, and threats – analytic hierarchy process (SWOT-AHP) – analysis of the identified factors. In order to identify the relative importance of each area, a pairwise analysis was conducted through a questionnaire survey targeting experts in businesses related to PL. The results suggest the greater importance of opportunities and strengths than threats and weaknesses, indicating that the enforcement of the PL law would provide SMEs more opportunities than burdens. Through these results the S/O, S/T, W/O, W/T strategies for SMEs, which can be preferentially implemented, were proposed.

Keywords: Product Liability (PL), Confrontation Strategy, PEST (Political, Economic, Social, and Technological) Analysis, SWOT, AHP (Analytic Hierarchy Process)

Introduction

The product liability (PL) law, which began enforcement in 2002, has imposed obligations on manufacturers to compensate for damages caused to a victim’s body and property due to defective products. Through this PL law, the government aims to contribute to the safety improvement of people's lives and healthy development of the national economy. In other words, by emphasizing the protection of the rights and interests of the consumers who use the products, PL becomes a system for increasing damage compensation available to consumers who are victims of defective products rather than a system for just helping manufacturers or dealers [2].

PL study status domestically and overseas

The main domestic and international study areas related to PL law include studies on the current status of responses to the law and measures taken by firms, the PL awareness of constituent members and consumers, prevention strategies, and damage case analyses.

The study methodologies related to PL were mainly surveys done through questionnaires. However, in recent years, various analysis techniques such as fuzzy logic, AHP, etc., are being used increasingly in deriving conclusions through case analysis, literature study, etc. As mentioned earlier, studies on the response measures taken by firms in relation to the PL law, and improvement of the measures of PL law have been actively conducted. However, there is a lack of studies that provide results applicable to SMEs by analyzing the effects of PL law enforcement on them from various viewpoints to evaluate the relative importance among the affecting factors.

Study results

**Pairwise comparison of PEST-SWOT group.** The importance and rankings of top factors, and sub-factors within the top factors, were derived by performing a 1:1 pairwise comparison of PEST-SWOT factors, based on the enforcement of PL law. For this purpose, the evaluator's consistent response was important, and to ensure this a consistency ratio was used. Consistency measures the logical inconsistencies of the evaluator's judgment; the degree of consistency is said to be consistent if the consistency ratio does not exceed 0.1[6].

Table 1 shows the results of the relative importance of PEST-SWOT factors. The importance of each PEST-SWOT factor was as follows: opportunities: 0.383; strengths: 0.328; threats: 0.161; and weaknesses: 0.128. The results imply that the enforcement of PL law does not result in weakening or threating effects on SMEs, which are exposed to a harsh environment; rather, the PL law offers strengths and opportunities for SMEs.

Table 1. Local and Global Weights of PEST-SWOT Group

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Group | Relative weights | Sub Group | Local  weights | Global weights | Rank |
| Opportunity | 0.383 | Supply Safe Products to Consumers(OP) | 0.346 | 0.137 | 1 |
| Strengthen Competitiveness of the Corporate(OE) | 0.275 | 0.109 | 2 |
| Protect Consumer Rights and Interests(OS) | 0.202 | 0.080 | 5 |
| Introduce System which aligns with International Standards(OT) | 0.178 | 0.071 | 6 |
| Strength | 0.328 | Corporate Effort Enhancement for Defective Products Reduction(SP) | 0.367 | 0.118 | 2 |
| Products Competitiveness Securement(SE) | 0.287 | 0.092 | 4 |
| Development of New Industry Associated with Safety(SS) | 0.170 | 0.055 | 9 |
| Securing Technology for Safety Enhancement(ST) | 0.176 | 0.056 | 8 |
| Threat | 0.161 | Occurrence of Business activity Inconvenience (TP) | 0.225 | 0.037 | 12 |
| Punitive Damages Occurrence(TE) | 0.269 | 0.045 | 11 |
| Corporate Image Damage(TS) | 0.346 | 0.058 | 7 |
| Corporate Technology Development and Innovation Impediment(TT) | 0.160 | 0.027 | 14 |
| Weakness | 0.128 | Increased Burden for Safety Enhancement(WP) | 0.401 | 0.046 | 10 |
| Increase in Manufacturing Cost(WE) | 0.306 | 0.035 | 13 |
| Generation of Business Weak in PL(WS) | 0.126 | 0.014 | 16 |
| New Product Development, Production and Sales Shrinkage(WT) | 0.167 | 0.019 | 15 |

**Calculating run length of EWMA charts**

The most common measure of control chart performance is average run length (ARL), which is based on the run length (RL) distribution. The number of samples needed for a control chart to signal is a run length or, equivalently, one observation of the RL distribution. The mean of the RL distribution is the ARL, which is actually the average number of observations needed for a control chart to signal. Usually, along with the ARL, the standard deviation of the run length (SDRL) is also computed. In this article, Markov chain method is used to calculate RL of the four EWMA charts. This procedure could be shown by WR EWMA chart as example. At first, dividing the interval between the upper control limits to center line into subintervals of width.

The rows of the transition probability matrix must add to 1 so that the probabilities of going from an in-control state to the out of control state are found by subtraction.

The th stage transition probability matrix is useful for evaluating the run length distribution because it contains the probabilities that the control statistic goes from one state to another state in  steps,

 (14)

Hence  and . (15)

Using equation (15), the ARL and SDRL based on  in-control states is given by

 (16)

 (17)

Conclusion

The study results are briefly summarized as follows. To continuously reduce product defects, it is necessary for SMEs to formulate PL response strategies for each phase of the product life cycle by continuously collecting and analyzing PL cases in the same industry or for similar products. Additionally, SMEs should invest more technological effort to ensure product safety. Further, SMEs should spread PL awareness to all staff members by training internal PL experts. Moreover, a SME should enroll in PL insurance and spread this information to its customers so that they become aware that the company is proactively conforming to the PL law.

The present study did not address characteristics by types of business due to time and cost; hence, the study results have limitations in that they cannot be applied to SMEs of all business types. To address this limitation, additional studies are required, which consider the characteristics of various businesses such as general machinery, automobile, shipbuilding, semiconductor, electrical and electronic industries, with experts from these various businesses as the target.

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