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An evaluation model of new product launch strategy

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Abstract

The objective of this article is to develop an empirically based framework for formulating and selecting a product launch strategy. Managers usually face Fuzzy decision scenarios. Traditional decision-making methods fail to satisfy a manager's need in this regard. Thus, a hierarchical fuzzy multi-criteria decision-making (Fuzzy MCDM) method for evaluating a new product launch strategy is proposed in this study. In order to show the practicality and usefulness of this model, an empirical study of the Taiwan IC industry is demonstrated. The results show that the fast follower strategy is the most applicable.

Keywords: Launch strategy; Product strategy

1. Introduction

Launching new products to market quickly is a prerequisite for acquiring a competitive advantage. Today, even some product development managers face intense pressure to bring world-class products to market in record time. Many factors contribute to this pressure, including acceleration in the rate of technological development, improved mass communication, more intense competition due to the maturing of markets and globalization, fragmentation of the marketplace due to changing demographics, shorter product life cycles, and the escalating cost of R&D (Ali et al., 1995). This accelerated rate of product obsolescence increases the need to develop new products quickly enough to ensure timely introduction during the product life cycle (Coredero, 1991). To be successful, perhaps even to survive, a company must master product strategy and skillfully navigate through proper development, and application and management of a product strategy that separates enduring success from failure (Mcgrath, 2000)

Conventional new product strategies often do not provide a sufficiently flexible perspective for analyzing the determinants of success in a highly competitive environment (Calantone and di Benedetto, 1990). Although, much empirical work has shown the importance of strategy for success (Cooper, 1980), authors sometimes show their own results as limited by certain environmental forces in subsequent studies (cf., Cooper, 1990). A number of issues recur as consistent correlates of new product success. One of the common factors identified is the impact of the new product's launch strategy on success (Hultink et al. 1997). Droge and Calantone (1996) examined the relationships among environment, strategy, structure and performance in the context of new product development. Muffatto (1999) introduced a platform strategy in product development. Ali et al. (1995) investigated the relative impact of product innovation and entry strategy on cycle time and initial market performance for small firms. Barczak (1995) proposed that a firm's choices of new product strategy, structure and process are interrelated, as are the effects of these choices on NPD performance. Hultink and Robben (1999) and Hultink et al. (1997,1998) constituted a launch strategy and examined how such decisions impact new product performance. Although previous research has investigated the concept and contents of new product performance and product launch strategy, there is still no consensus on decisions related to how a launch strategy is selected and formulated. Moreover, while other success differentiators have been researched extensively, studies that derive the details of the anatomy of a launch strategy, and the formulation and selection of a strategy are few in number.

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The purpose of this article is to develop an empirically based framework for formulating and selecting a product launch strategy. A hierarchical fuzzy multi-criteria decision-making (Fuzzy MCDM) method is proposed. In order to show the practicality and usefulness of this model, an example is offered to verify this method.

The remainder of this paper is organized into four sections. First, we review the literature pertaining to product launch strategy and derive a hierarchical strategy model as our main framework for research. We then give the details of this method. This method was then used to analyze the Taiwan IC industry. Finally, we discuss the results and implications of this model.

2. Product strategy

Competitive advantage is derived from increases in customer-delivered value that typically involves product strategy, especially launch strategy. Past research on the market timing or entry decision issue suggests that the entry strategy affects the entrants' performance in the marketplace (Ali et al., 1995). Calantone and Montoya-Weiss (1993) noted that product launch is often the most expensive, risky and least well-managed part of the overall product development process. A launch plan is described in terms similar to a marketing plan: identify target markets, establish marketing mix roles, forecast financial outcomes and control the project (Hultink et al., 1997). Gatignon et al. (1990) suggested that entry strategy encompasses the marketing mix variables, in particular the positioning of the new brand in relation to currently competing brands and the marketing activities undertaken to support the entry.

Unfortunately, while these prescriptions provide the steps one should go through in putting together a launch plan, they provide no explicit advice as to what decisions go into launching a new product and whether or which of these decisions may be interdependent (Hultink et al., 1997). In this regard, Hultink et al. (1997) presented a rigorous identification of the launch strategy components by reviewing the previous launch strategy literature and interviewing managers responsible for making launch decisions. These strategic launch decisions govern what to launch, where to launch, when to launch, and why to launch. The product launch decisions laid out above are based on a mix of strategic and tactical decisions that must be mutually reinforcing to produce new product development success (see Fig. 1).

New product strategy crafting varies widely across companies and competitors even in the same industry (Wind and Mahajan, 1988), a situation which points out the importance of the "match" or "fit" between the competitor environment and the new product strategy (Calantone and Cooper, 1981). Droge and Calantone (1996) specified environmental dominance as a possible moderator and structure as a possible mediator to evaluate for their impact on product strategy and performance that is positive.

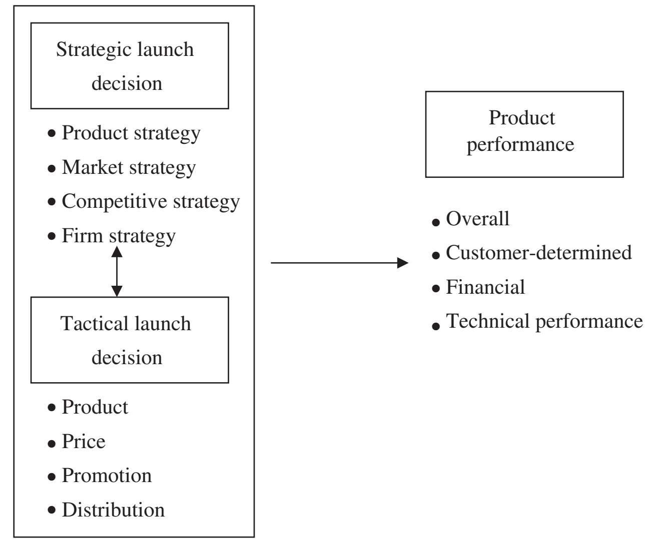

Fig. 1. Impact of launch decisions on new product performance. *Source*: Hultink et al., 1997. Industrial new product launch strategies and product development performance. Journal of Product Innovation Management 14, 243–257.

Product launch strategies have been applied in a number of ways. Ali et al. (1995) defined four entry strategy variables. They are market pioneering, product advantage, relative promotional effort, and relative price. Ansoff and Stewart (1967) developed a typology of strategies based on the timing of the entry of a technological firm into an emerging industry. Miles and Snow (1978) created four strategic types based on the rate at which a firm changes its products or markets in response to its environment. Cooper (1985) identified strategic types based on factors that contribute to new product success. Barczak (1995) developed three strategic types based on the timing of entry, first-to market, fast follower, and delayed entrant. Hultink et al. (1997) developed four kinds of launch strategies according to two dimensions: product innovativeness and product newness, which are niche followers, niche innovators, mass marketers and would-be me-toos.

3. Evaluation model for selecting the best product launch strategy

This study applied the PATTERN (Planning Assistance Through Technical Evaluation of Relevance Number) method and concept (NASA PATTERN, 1965, 1996; Tzeng, 1977; Tzeng and Shiau, 1987) to build a hierarchical strategy system for evaluating a product launch strategy. These procedures stem from three steps: (1) scenario writing, (2) building a relevance tree, and (3) evaluation. Scenario writing is based on catching the habitual domain (Yu, 1985, 1990, 1995), i.e., past understanding of problems, experience, knowledge and information derived

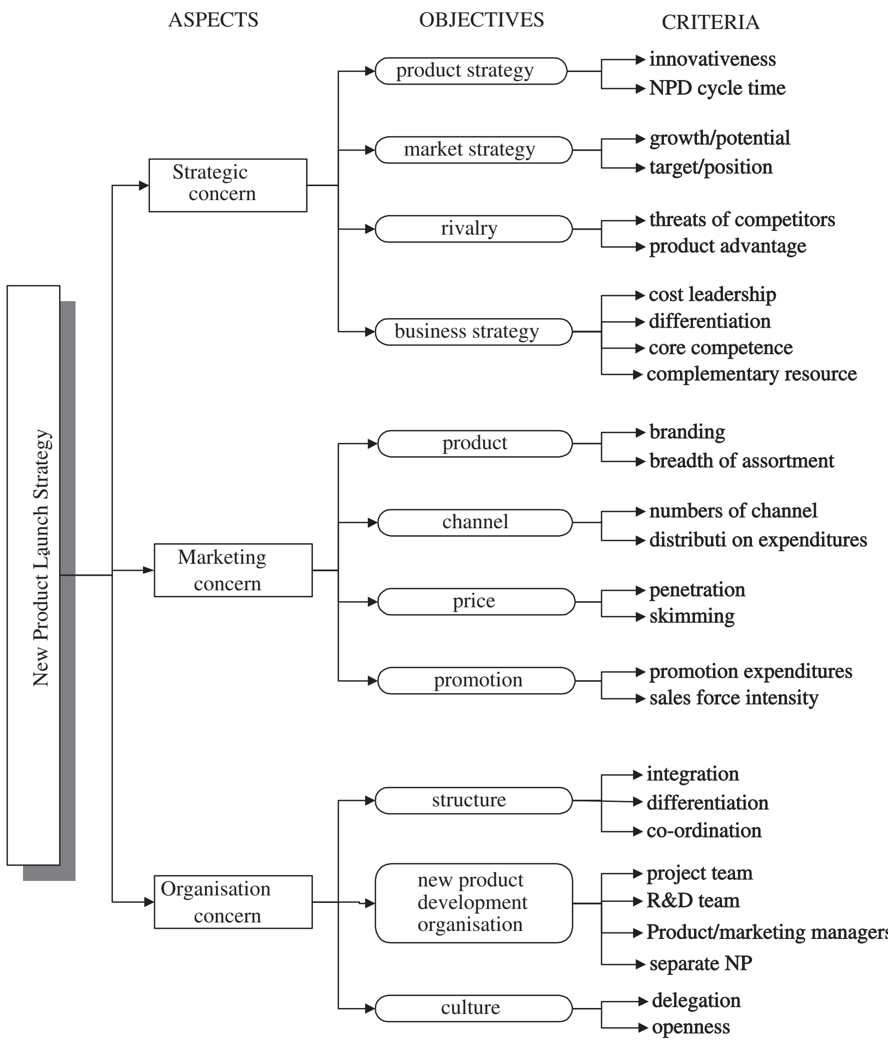

Fig. 2. Relevance system of hierarchy tree for evaluating product launch strategy.

from brainstorming techniques to identify the factors affecting the success and performance of new product development discussed in previous sections. Three aspects have been identified: strategic concern, marketing concern, and organization concern. Accordingly, the relevance trees, based upon the literature reviews and interviews with managers, are used to construct hierarchy strategies for attaining product development success and promoting the overall performance stated in the scenario writings. The elements (nodes) are defined and identified in hierarchy strategies, the combination of which institutes an evaluation mechanism for selecting a product launch strategy as shown in Fig. 2.

From the literature review and manager interviews, this study adopted Barczak's (1995) definition of product strategy and categories, which are as follows: First-to-market, Fast Follower, and Delayed entrant.

Table 1 provides the evaluators (experts) with a consideration base for rating the product strategy based on various criteria. According to the impact from the number of criteria to different industries and companies, the experts evaluate different product strategies. The evaluation method is proposed in the next section.

Table 1
Categories and definition of launch strategy

Launch strategy	Definition
First-to-market	First-to-market and with new products
Fast follower	A fast follower, learns quickly from those companies who enter first
Delayed entrant	A delayed entrant that likes to enter established markets

3.1. Evaluating the product launch strategy hierarchical system

Traditional evaluation methods usually take the minimum cost or maximum benefit as the only measurement index (Tzeng and Tasur, 1993; Tasur et al., 1997). In an increasingly complex and diversified decision-making environment, this approach may ignore too much valuable information in the process. Therefore, in this study we propose a multiple-criteria decision-making (MCDM) method to evaluate the hierarchical system for selecting product strategies. Furthermore, the concept of perceived criteria in decision-making process is most often vague. When this happens, the decision-making process becomes ambiguous and subjective for the decision-maker. While the extent to which vague criteria are captured by research is unknown, it is certain that the evaluation is conducted in an uncertain, fuzzy environment (Tang and Tzeng, 1999). This has surely happened in formulating product launch strategy. Therefore, in this study, we applied a fuzzy multiple-criteria evaluation method for selecting product strategies to match the real scenario faced by managers or decision-makers.

3.1.1. The process for evaluating and selecting product launch strategies

The process for selecting product strategies includes three steps:

3.1.1.1. Evaluating the weights for the hierarchical relevance system. The AHP weighting (Saaty, 1977, 1980) is determined by the evaluators who conduct pair-wise comparisons, by which the comparative importance of two criteria is shown. Furthermore, the relative importance derived from these pair-wise comparisons allows a certain degree of inconsistency within a domain. Saaty used the principal eigenvector of the pair-wise comparison matrix derived from the scaling ratio to determine the comparative weight among the criteria.

Suppose that we wish to compare a set of n criteria in pairs according to their relative importance (weights). The criteria are denoted by C_1, $C_2;\ldots,C_n$ and their weights by $w_1,w_2,\ldots,w_n$ if $\boldsymbol{w}=(w_1,w_2,\ldots,w_n)^t$. A matrix A with the following formulation may represent the pair-wise comparisons:

$$(\boldsymbol{A}-\lambda_{\max}\boldsymbol{I})\boldsymbol{w}=\boldsymbol{0}. \tag{1}$$

Eq. (1) indicates that $\boldsymbol{A}$ is the matrix of pair-wise comparison values derived from intuitive judgment for the ranking order. In order to determine the priority eigenvector, we must find the eigenvector $\boldsymbol{w}$ with respective $\lambda_{\max}$ that satisfies $\boldsymbol{Aw}=\lambda_{\max}\boldsymbol{w}$. Observations are made from the intuitive ranking order judgment to pair-wise comparisons to test the consistency of the intuitive judgment. This is because small changes in the matrix $\boldsymbol{A}$ elements imply a small change in λ_j, $\left(\sum_{j=1}^{n}\lambda_i = tr(A) =\right.$ the sum of the diagonal elements-n. Therefore only one of λ_j, we call it $\lambda_{\max}$, equals n, and if $\lambda_j=0$, the $\left.\lambda_{\mathrm{j}}\neq I_{\max}\right)$. The deviation in the latter from n is a measure of consistency, i.e., $CI=(\lambda_{max}-n)/(n-1)$, with the consistency index (CI) as our indicator of "closeness to consistency". In general, if this number is less than 0.1, we may be satisfied with our judgment (Saaty, 1997, 1980)

3.1.1.2. Getting the performance value. Each product strategy will acquire a score from the evaluators based upon their own subjective knowledge. Because of personal limitations such as habitual domain or asymmetrical information, a fuzzy environment has been formed. Thus, applying the fuzzy theory in solving this problem becomes essential. Since Zadeh (1965) introduced the fuzzy set theory and Bellman and Zadeh (1970) described the decision-making method in fuzzy environments, the application of this theory has become more popular, and a number of studies have been published applying similar methods. The procedures are described as follows:

(1) *Fuzzy number*: Fuzzy numbers are a fuzzy subset of real numbers that represent the expansion of the idea of the confidence. Dubis and Prades (1978) stated that the fuzzy number $\tilde{A}$ is a fuzzy set and its membership function is $\mu_{\tilde{A}}(x)$: $R\rightarrow[0,1]$, where x represents the strategies and is enshrined with the following characteristics:

- $\mu_{\tilde{A}}(x)$ is a continuous mapping from R to the closed interval between 0 and 1;
- $\mu_{\tilde{A}}(x)$ is a convex fuzzy subset; and
- $\mu_{\tilde{A}}(x)$ is the normalization of a fuzzy subset, which means that there exists a number x_0 that makes $\mu_{\tilde{A}}(x_0)=1$.

Those numbers that can satisfy these requirements will then be called fuzzy numbers. The following is an explanation for the characteristics and operation of the triangular fuzzy number $\mu_{\tilde{A}}(x)=(L,M,U)$ as shown in Eq. (2) and Fig. 3.

$$\mu_{\tilde{A}}(x)=\begin{cases}(x-L)/(M-L), & L\leqslant M\leqslant M,\\ (U-x)/U-M & M\leqslant x\leqslant U,\\ 0 & \text{otherwise}.\end{cases} \tag{2}$$

According to the characteristics of triangular fuzzy numbers and the extension principle put forward by Zadeh

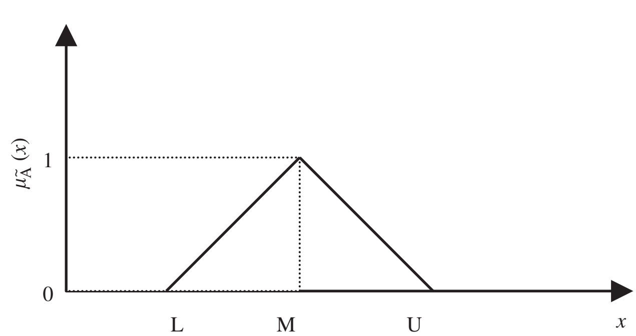

Fig. 3. The membership function of the triangular fuzzy number.

(1965), the algebraic operation for the triangular fuzzy number can be displayed as follows:

- Addition of a fuzzy number $\oplus$

$$(L_1, M_1, U_1) \oplus (L_2, M_2, U_2) = (L_1 + L_2,\ \ M_1 + M_2,\ U_1 + U_2). \tag{3}$$

- Multiplication of a fuzzy number$\odot$

$$(L_1, M_1, U_1) \odot (L_2, M_2, U_2) = (L_1L_2,\ \ M_1M_2,\ U_1U_2). \tag{4}$$

- Any real number k

$$k \odot \mu_{\tilde{A}}(x) = k \odot (L, M, U) = (k\,L, k\,M, k\,U). \tag{5}$$

- Subtraction of a fuzzy number $\ominus$

$$(L_1, M_1, U_1)(L_2, M_2, U_2) = (L_1 - U_2,\ M_1 - M_2\ \ U_1 - L_2). \tag{6}$$

- Division of a fuzzy number $\oslash$

$$(L_1, M_1, U_1)(L_2, M_2, U_2) = (L_1/U_2,\ M_1/M_2, U_1/L_2). \tag{7}$$

(2) *Linguistic variable*: Conventional quantification methods are difficult to express reasonably for situations that are overtly complex or ambiguous. Therefore, the notion of a linguistic variable is necessary in describing such situations. For example, the criteria expressions such as "product innovativeness," "threats of competitors," "product advantages," and so on all represent linguistic variables in the context in these problems (see Fig. 4). Linguistic variables may take on effect-value such as "very high (very good)," "high (good)," "fair," "low (bad)," and "very low (very bad)." The use of linguistic variables is rather widespread at present, and the linguistic effect values for a product launch strategy found in this study are primarily used to assess the linguistic ratings given by the evaluator. Furthermore, linguistic variables are used as a way to measure the performance value achievement for each criterion/objective.

3.1.1.3. Evaluating product launch strategies. Bellman and Zadeh (1970) were the first to probe the decision-making problem in a fuzzy environment, for which they initiated fuzzy multiple-criteria decision-making (Fuzzy MCDM). Our study uses this method to evaluate various product strategies and ranks them by their performance. The methods and procedures of the Fuzzy MCDM theory are as follows:

(1) *Measuring criteria*: Using linguistic variable measurement to demonstrate the criteria performance (effect values) with expressions such as "very high," "high," "fair," "low," and "very low," the evaluators were asked to make subjective judgments. Each linguistic variable can be indicated using a triangular fuzzy number (TFN) within a range of 0–100. Alternatively, the evaluators could subjectively assign their own personal weights to the linguistic variables. Let E_{ij}^k indicate the fuzzy performance value of evaluator k toward strategy i under criteria j. Let the performance of the criteria be indicated by the set S; then,

$$E_{ij}^k = \left(LE_{ij}^k, ME_{ij}^k, UE_{ij}^k\right), j \in S. \tag{8}$$

Because the perception of each evaluator varies according to the evaluator's experience and knowledge, and the definitions of the linguistic variables vary as well, this study used the notion of average value to integrate the fuzzy judgment values of m evaluators, that is,

$$E_{ij} = (1/m) \odot \left(E_{ij}^1 \oplus E_{ij}^2 \ldots \oplus E_{ij}^m\right). \tag{9}$$

The sign $\odot$ denotes fuzzy multiplication and the sign $\oplus$ denotes fuzzy addition. E_{ij} is the average fuzzy number for the judgment of the decision-maker. It can be displayed using a triangular fuzzy number as follows:

$$E_{ij} = \left(LE_{ij}, ME_{ij}, UE_{ij}\right). \tag{10}$$

The preceding end-point values

$$LE_{ij} = (1/m) \odot \left(\sum_{k=1}^{m} LE_{ij}^k\right), ME_{ij} = (1/m) \odot \left(\sum_{k=1}^{m} ME_{ij}^k\right), UE_{ij} = (1/m) \odot \left(\sum_{k=1}^{m} UE_{ij}^k\right),$$

can be solved using the method introduced by Buckley (1985).

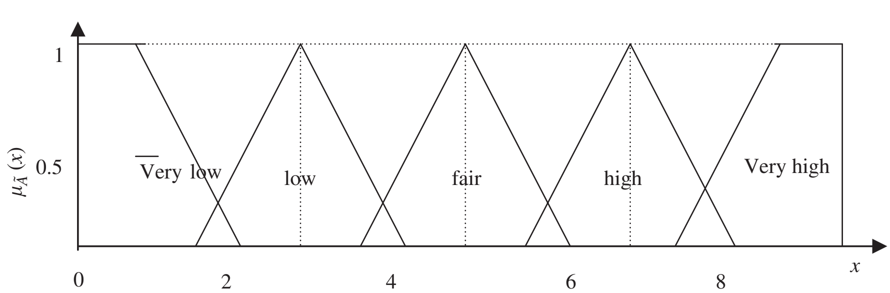

Fig. 4. The membership function of the five levels of linguistic variables (hypothetical example).

(2) *Fuzzy synthetic decision*: The weights of the different criteria as well as the fuzzy performance values (effect-values) must be integrated using the fuzzy number operation located at the fuzzy performance value (effect-values) of the integral evaluation. According to the weight w_j, derived by AHP, the weight vector and the fuzzy performance matrix E of each of the strategy can be obtained from the fuzzy performance value of each strategy under n criteria/objectives, that is,

$$\boldsymbol{w} = \left(w_1, \ldots, w_j, \ldots w_n\right)^t, \tag{11}$$

$$E = \left(E_{ij}\right), \tag{12}$$

$$R = E \Leftrightarrow \boldsymbol{w}, \tag{13}$$

where the sign "$\Leftrightarrow$" indicates the fuzzy number operation. Because fuzzy multiplication is rather complex, it is usually denoted by the approximate fuzzy multiplication result and the approximate fuzzy number R of the fuzzy synthetic decision for each strategy. The expression then becomes

$$R_i = (LR_i, MR_i, UR_i), \ \forall_i, \tag{14}$$

$$\text{where } LR_i = \sum_{k=1}^{m} LE_{ij} \odot w_j, \tag{15}$$

$$MR_i = \sum_{k=1}^{m} ME_{ij} \odot w_j, \tag{16}$$

$$UR_i = \sum_{k=1}^{m} UE_{ij} \odot w_j, \tag{17}$$

(3) *Evaluation of the strategies (fuzzy number)*: The fuzzy synthetic decision result reached using each strategy is a fuzzy number that can be employed during the comparison of strategies. In other words, the defuzzification procedure involves locating the Best Nonfuzzy Performance value (BNP). The BNP value for the fuzzy number R_i can be found using the following equation:

$$BNP_i = [(UR_i - LR_i) + (MR_i - LR_i)]/3 + LR_i, \forall i. \tag{18}$$

(4) *Selecting the strategies (TOPSIS method)*: MCDM is about selecting the best alternative among a set of alternatives. This is usually achieved by constructing a preference order for the alternatives based on their "performance" with respect to the criteria considered. This research adopted TOPSIS (Techniques of Preference by Similarity to the Ideal Solution) methods to evaluate the BNP value. Based upon the BNP value, we can select the best alternative. TOPSIS, developed by Hwang and Yoon (1981), is very unique in the way it approaches a problem and is intuitively appealing and easy to understand. Its fundamental premise is that the best alternative, say ith, should have the shortest Euclidean distance $S_i^+ = \left[\sum\left(r_{ij} - r_j^+\right)^2\right]^{1/2}$ from the ideal solution (r_j^+, made up of the best value for each criterion regardless of the alternative), and the farthest distance $S_i^- = \left[\sum\left(r_{ij} - r_j^-\right)^2\right]^{1/2}$ from the negative-ideal solution (r_j^- made up of the worst value for each criterion). The alternative with the highest relative closeness measure $S_i^+/\left(S_i^+ + S_i^-\right)$ is chosen as the best one.

4. Empirical study and discussions

We propose an empirical study of the Taiwan IC industry for product launch strategy selection to show the practicability and usefulness of the proposed method through 50 samples. The data for this study were collected in the summer of 2001 in Taiwan. One hundred-fifty managers in this industry were phoned to explain the purpose of the study, to verify whether the respondent was responsible for new product launch, and to gain their cooperation. Eighty-two managers agreed to attend this study and received the mail questionnaire. A total of 50 valid questionnaires were returned. The majority of the respondents worked in the marketing, R&D, or PM (product marketing) department. The IC company strategy evaluation process is demonstrated as follows:

(a) *Evaluating the criteria/objective weights*: Using the AHP method, the weights of various criteria, objectives, and aspects were found and are shown in Table 2.

(b) *Estimating the performance matrix*: The evaluators could define their own individual range for the linguistic variables employed in this study according to their subjective judgments within a scale of 0–9. This study could thus employ the average value method to integrate the fuzzy judgment values of different evaluators regarding the same evaluation criteria. In other words, fuzzy addition and fuzzy multiplication can be used to solve the average fuzzy numbers for the performance values under each criterion shared by the evaluators for product launch strategy.

(c) *Evaluation and selection of the product launch strategy*: From the criteria weights obtained using the AHP method (Table 2) and the fuzzy performance values for each criterion, the final fuzzy integrated decision could then be made. After the fuzzy integrated decision was chosen, the nonfuzzy ranking method was employed, and the fuzzy numbers were then changed into nonfuzzy values. This study used TOSIS to calculate the BNP value (see Table 3) and then to select the product launch strategy according to the performance of different alternatives. The result shows that the fast follower strategy was applicable to the Taiwan IC industry, and first-to-market outperformed the last entrant strategy.

4.1. Discussion and managerial implications

The focus of this study was a new product launch strategy model to assist mangers to succeed in

Table 2
The criteria weights for evaluating strategies

Aspects/objectives/criteria		Weights	Total weights (w_j)
Strategic concern	0.499		
Product strategy		0.143	
Innovativeness			0.073
NPD cycle time			0.071
Market strategy		0.131	
Growth/potential			0.058
Target/position			0.073
Rivalry		0.064	
Threats of competitors			0.021
Product advantage			0.043
Business strategy		0.161	
Cost leadership			0.020
Differentiation			0.050
Core competence			0.076
Complementary resource			0.016
Marketing concern	0.38		
Product		0.126	
Branding			0.057
Breadth of assortment			0.069
Channel		0.107	
Numbers of channel			0.060
Distribution expenditures			0.047
Price		0.074	
Penetration			0.039
Skimming			0.035
Promotion		0.073	
Promotion expenditures			0.049
Salesforce intensity			0.024
Organization concern	0.121		
Structure		0.031	
Integration			0.018
Differentiation			0.004
Coordination			0.009
New product development organization		0.045	
Project team			0.014
R&D team			0.005
Product/marketing managers			0.020
Separate NP			0.006
Culture		0.045	
Delegation			0.033
Openness			0.012

Table 3
The evaluation results of new product launch strategy

Product launch strategy	BNP_i	Ranking
(A) First to market	0.0728	2
(B) Fast follower	0.2608	1
(C) Delayed entrant	0.0157	3

decision-making, and our empirical study demonstrated the validity of this model. In our study, a useful product launch strategy stems from three aspects: strategy, marketing, and organization. The relative objectives and evaluation criteria were defined in this research.

This empirical study showed that the major managers of the Taiwan IC industry, after evaluating all criteria, take the fast follower strategy for granted as the best and most applicable alternative for the Taiwan IC industry. Tracing the history of the Taiwan IC industry, we can easily see that the fast follower strategy was the key successful factor in Taiwan's development. In the preliminary stage, a number of technologies from the RCA Corporation were transferred to Taiwan. These technologies provided the very foundation of future development. Gradually, Taiwan has cultivated the needed technologies and created new business models such as foundry, etc. It appears that with limited resources, capabilities, and market sizes, the fast follower strategy can reduce the risks and uncertainties. Moreover, it helps to determine the niche market and the direction of leading countries' technology capacity with which Taiwan must catch up. Comparing the result of this model and Taiwan's practical development history, there is no conflict, again proving the validity of this model.

When a new product is going to be launched, managers are always confused about finding the proper strategy. The major reasons for the are the fuzzy environment that they face and too many criteria that they fail to recognize and identify. This model guides managers step-by-step in solving these problems. With the help of this model, managers can arrange different disciplinary experts to conduct the same proposed procedure and thus determine the best alternative. The subjective judgment and risks of wrong decisions can then be decreased to a minimum degree. Actually, this method can be implemented in solving other kinds of problems. Users can learn from this model and modify the constructs of the hierarchy trees. Generally speaking, the empirical findings, brainstorming, Delphi, and literature review all help to set out the relevant aspects, objectives and criteria. Managers can not only apply this method to new product development but also in strategy planning or other relative decision-making issues.

5. Conclusions

Technology development brings prosperity to nations, but the successful commercialization of this technology is the real meaning of innovation. For this reason, all companies have tried their best to launch maximum numbers of products to market. However, the commercial success or failure of a product does not rest solely on the product itself. The launch strategy adopted also determines whether a product succeeds or fails. The key to success in the launch process often rests in finding the proper strategies.

Our empirical study example on the Taiwan IC industry which is based on the results of a generalized model evaluating product launch strategies in a fuzzy environment has demonstrated the validity of this model, as compared with the history of the Taiwan IC industry.

Previous studies have discussed a number of relevant issues, but few studies have addressed new product launch strategy planning. Given that this is a first attempt to formally model the formulation process for a new product launch strategy using fuzzy MCDM, we believe that the insights gained herein are a significant theoretical contribution to the literature and lay the groundwork for future research. Although we endeavored to be as complete as possible in the model setting in this study, there may be additional criteria and methods that should be considered and added to future research. The aspects, objectives, and criteria may require future modification. Different group decision-makers will also influence the results. Future research could compare the results from different groups of decision-makers. Based upon these differences, some managerial implications could be identified.

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