

# The Impact of New Product Strategy on Product Performance and Evaluative Criteria

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## Abstract

This study examines the relationship between new product strategy and NPD performance, and also investigates that under different new product strategies, what are the patterns of usage of evaluative categories over NPD evaluative gates, and what are the most frequently used, appropriate evaluative criteria at each development gate throughout the NPD process. Based on a survey of 87 successful new product projects, first of all the results indicate that any new product strategy can be effective, and no one strategy is better than another. More importantly, the aggregated results across new product strategies show that market category is used most frequently at the idea screening, decision on business case and post-launch review gates; financial category shrinking appears on the decision on business case and post-launch review gates; technical category figures noticeable in the idea screening and product testing gates; time category and opportunity category are rarely emerged in the ranked list. In addition, the most frequently used criteria at the NPD evaluative gates alongside various new product strategies are also presented. Finally, we conclude with theoretical contributions and Managerial implications.

**Keywords:** Evaluative criteria, New product strategy, New product development performance

## **1. Introduction**

It is widely agreed that the development of new products is of increasing importance to profitability and competitiveness especially for large manufacturers in such technology-intensive industries as electrical machinery, telecommunication, photonics, semiconductor and information. As the characteristic of risk of high failure rate is embedded in new product development (NPD) process, Managers have recognized that effective project evaluation is critical to successful new product programs (Cooper, 2001). Introducing the evaluative gate taken place between each development stage is a method for Managing the risks of new products (de Brentani, 1986; Kuczumski, 1988; Crawford, 1989; O' Connor, 1996), and the evaluative criteria within the gate is used to assess information from corresponding development stage stages in order to determine the go/no-go decision and accelerate the accuracy of the project.

Reviewing extant literatures find that almost studies focus on exploring how evaluative criteria are employed throughout the NPD process (Ronkainen's, 1985; Tzokas et al. 2004; Pilar et al., 2004). But researchers ignore an issue raised in the literature that not all new products are the same (Kleinschmidt and Cooper, 1991). Some new products are perceived by customers to be slight improvements over competitive products, whereas other products are new to the world. The type of new product should be defined clearly as research findings vary with the type of NPD (Atuahene-Gima, 1995; Craig and Hart, 1992; Rochford and Rudelius, 1997). Therefore, there is an opportunity to further investigate what are the patterns of usage of evaluative categories over NPD evaluative gates, and what are the most frequently used, appropriate evaluative criteria at each development gate throughout the NPD process. In addition, previous literatures show an inconsistent, contradictory result as to the relation between new product strategy and NPD performance (Robinson, Fornell, and Sullivan, 1986; Kotabe, 1990; Schnaars, 1992; O'Connor, 1998; Song and Monoty-Weiss, 1998). The positive or negative relation gives rise to many challenges to firms and their Managers, for example including determining the new product strategy. Thus, our aim is to reexamine this matter. This study here shed light on two aforementioned research questions.

The remainder of this article is organized as follows. Section 2 conveys relevant literatures and develops the research statements that guided the research. In section 3 are discussions of the research methodology, sample characteristics, and measures. In section 4 the results of the investigation are presented. Then section 5 of the article provides conclusions, limitations of the study and future research directions.

## **2. Literature Review**

### **2.1 NPD process**

A common NPD process is subdivided into many stages. Between each stage, there is an evaluative gate to determine whether the new product should advance further or be terminated (Cooper and Kleinschmidt, 1986; Page, 1993). An overview of a stage-gate system are idea, initial screen, preliminary assessment, second screen, detailed investigation (business case preparation), decision on business case, development, post-development review, testing and validation, pre-commercialization business analysis, full production and market launch, and post-implementation review (Cooper, 1990).

Booz, Allen, and Hamilton (1982) were the first to indicate that the new product process was a key to successful new product performance. For example, Northern Telecom, a leading firm in the field of product development, implemented their four-stage gating system for new product, and then obtained prominent results: shorter times to launch, fewer mistakes, less recycling and rework in the process, and a more successful development effort. Evaluative gates Manage risks derived from innovation (Crawford, 1989; de Brentani, 1986; Kuczumski, 1988; O'Connor, 1996), monitor quality of the project, and avoid go/no-go errors during the development process (Cooper, 2001). Within each

gate, criteria are used to evaluate new product and make go/no-go decisions. It is widely recognized that implementing a stage-gate process will achieve a much higher level of new product performance.

## **2.2 Evaluative criteria for NPD gates**

The subject on the measurement of NPD performance has one of research streams over the past years (Cooper, 1984; Sbragia, 1984; Cusumano and Nobeoka, 1991; Page, 1993; Griffin and Page, 1993; Barczak, 1995; Calantone et al., 1995; Olson, et al., 1995; Loch et al., 1996; Cooper and Kleinschmidt, 1996; Song, et al., 1998; Souder et al., 1998; Kusunoki et al., 1998; Driva et al., 2000; Swink, 2000; Gruner and Homburg, 2000; Millson and Wileman, 2002). It is reasonable to argue that the indicators of NPD performance are the basis of evaluative criteria used in NPD gates. Ronkainen (1985) divided evaluative criteria of NPD gates into three categories, including product market, and finance. Hauser and Zettelmeyer (1997) pointed out that the best metrics depend on the goals of different types of research, development, and engineering activities (i.e., projects, programs, and explorations). The dimensions of metrics include strategic goals, quality/value, people, process, customer, and revenues/costs. Tzokas et al. (2004) grouped evaluative criteria into five dimensions: market-based, financial-based, product-based, process-based, and intuition-based. Factorial analysis was conducted with the go/no-go criteria in Pilar et al.'s work (2004). Five dimensions of evaluative criteria are technical feasibility, strategic fit, customer acceptance, financial performance, and market opportunity. Detailed information is listed in Appendix 1.

## **2.3 New product strategy**

New product strategy has been operationalized as the types of new products developed by a firm that denotes the innovativeness of the new products (Barczak 1995). For instance, there are different categories of new products that can be placed on a continuum from pioneering to incremental innovation. Ansoff (1957) proposed a framework with newness to the market and newness to the company, grouping new products into six distinct categories: (1) new to the world: new products that create and entirely new market; (2) new product company: new products that allow a company to enter an established market for the first time; (3) additions to existing product lines: new products that supplement a company's established product lines; (4) improvement and revisions to exiting products: new products that provide improved performance or greater perceived value and replace existing products; (5) repositionings: existing products targeted to new markets or market segments; (6) cost reductions: new products that provide similar performance at lower cost. Song and Montoya-Weiss (1998b) utilized Ansoff's product market matrix model considering the growing in our current market and technology strategy. Then results lead to incremental NPD. A development strategy that pursues a new market with a new product and technology will create a "real new product"; a strategy involving a current market and new product or new market and current product is classified as a moderate innovation.

Based on previous strategy, other researchers have devised different classifications to label a product's degree of innovativeness. For example, Crawford and Di Benedetto (2002) suggested five types of new products: (1) new to the world product i.e. inventions; (2) new categories entries: product new to the firm, but not new to the world; (3) additions to product lines: products that are line extensions, flankers in the firm's current markets; (4) product improvement: current products made better; (5) repositioning: products that are retargeted for a new use or applications. Although all of the previous strategies have been used in the NPD studies, Kleinschmidt and Cooper (1991) developed a triad categorization to capture varying levels of innovativeness and a firm's new product strategy. The types of innovation are distinguished into: (1) highly innovative products including new-to-the-world products and new to the firm lines; (2) moderately innovative products consisting of lines new to a

firm, but not new to the world and improvement items in existing product lines; (3) low innovative products including all product modifications, cost reductions and repositionings.

## **2.4 Research Question**

Highly innovative products entail potentially great rewards for companies (O'Connor, 1998; Song and Monoty-Weiss, 1998). Kotabe (1990) indicated in his study that the product innovation level has a direct relation to NPD performance, i.e. the higher the product innovation level, the better performance. However, several researchers challenge whether this is always true. For instance, Robinson, Fornell, and Sullivan (1986) indicated that pioneering firm's skills and resources are different from, but not superior to later entrants. Therefore, it does not assert that pioneers are stronger than later entrants. Furthermore, Schnaars (1992) concluded by saying that "no one timing strategy is best; each has produced its share of winners and losers". As a result of previous contradictory arguments, in order to deeply understand the relationship between new product strategy and NPD performance, in this paper we tend to conduct a survey to reexamine this matter.

Griffin and Page (1996) suggested that the measures for assessing project-level success depend on the project strategy. For instance, the ranking of the importance showed that market share, revenue or satisfaction, met profit goal, and competitive advantage are the most appropriate set of measures for evaluating NPD outcome under new-to-the-company strategy. Hauser and Zettelmeyer (1997) concluded that metrics that are best for one type of activity may be counter productive for another type. Atuahene-Gima (1995), Craig and Hart (1992), and Rochford and Rudelius (1997) indicated that research results vary with type of NPD. It is logical to consider that evaluative criteria are derived from the firm's new product strategy and are centered to the specific requirements of each stage of the NPD process. Therefore, in this paper, we are interesting to investigate that under highly, moderately and low innovative strategies, what are the patterns of usage of evaluative categories over NPD evaluative gates, and what are the most frequently used, appropriate evaluative criteria at each development gate throughout the NPD process

## **3. Methodology**

### **3.1 Measure development**

A pool of items was provided by a questionnaire asking respondents to provide background information and NPD project characteristics. Most of the questions in the document were patterned after items found from literature search and interviews with academics and practitioners. The questionnaire was pretested with several academics and NPD executives. The participants were asked to examine the initial questionnaire in order to eliminate/revise confusing questions and identify interpretation problems. By the end of the pretest, the questionnaire was ready for final administration.

### **3.2 Study measures**

#### **3.2.1 NPD process and corresponding evaluative gates**

For the NPD process, the respondents were asked to indicate the extent to which they engaged in particular activities when developing a new product. A NPD process is made up of development stages (idea generation, detailed business case, product development, testing and validation, and commercialization) and corresponding evaluative gates (initial screening, decision on business case, product testing, pre-commercialization testing, and post-launch review separately).

#### **3.2.2 Evaluative criteria of each evaluative gate**

Respondents were asked to answer the questions based on their successful NPD project that had fully launched. Evaluative criteria were adapted and developed from the literature (Griffin and Page, 1993; Tzokas et al., 2004). These indicators were grouped into five categories: market category

includes customer satisfaction, customer acceptance, sales objectives, sales growth, market share, sales volume, market potential; financial category consists of break-even time, profit objectives, internal rate of return, margin rate; technical category is composed of product performance, quality, product uniqueness, technical feasibility; time category comprises stay within budget, introduced in time, time to market; opportunity category is made up of marketing chance, intuition.

### **3.2.3 New product development performance**

NPD performance is a multifaceted construct (Griffin and Page, 1996). Respondents were asked whether their new products tended to fall below, meet, or exceed sales, profit, and market share goals. These three measures have been identified by Griffin and Page (1993) as core measures of new product performance. Overall satisfaction with their firms' NPD effort has also been identified as an appropriate measure of performance. The construct was measured using 5-point scale (1=strongly disagree, 5= strongly agree) in this study. To ensure the reliability of the performance variable, Cronbach's alpha was used. The coefficient is 0.84. Alphas>0.7 indicate high reliabilities according to Nunnally (1978).

### **3.2.4 New product strategy**

New product strategy was measured by asking respondents to indicate which one of three strategies they tend to use for their new product project. The three strategies offered were (1) highly innovative products: new-to-the-world products and new to the firm lines; (2) moderately innovative products: lines new to a firm, but not new to the world and existing items in existing product lines; (3) low innovative products: product modifications, cost reductions and repositionings. These measures have been used by Cooper (1991).

## **3.3 Data collection**

Our sampling frame encompasses manufacturing companies in Taiwan with more than 50 employees; firms with less than 50 employees were not chosen because they are more likely to have more idiosyncratic NPD activities. The industries including electrical machinery, telecommunication, photonics, semiconductor and information are with high percentages of sales coming from highly innovative products. A total of 250 questionnaires were mailed to NPD executive of firms selected from commercial address list, and 87 were complete to be used for the analysis, yielding a valid response rate of 34.8%.

The sample can be described as follows: on average, 23% of the responding firms belonged to the electrical machinery, 18% to telecommunication, 20% to photonics, 18% to semiconductor, and 21% to information. Moreover, 80% of the respondents had been with the company for more than 5 years. This implies that the respondents have sufficient experiences and knowledge to provide us NPD practices. To test the impact of possible non-response biases, responses of early and late waves of returned surveys were compared. This commonly used method is based on the assumption that the opinions of late responders are representative of non-respondents (Armstrong and Overton, 1977). The tests indicated no significant differences across the groups for any of the variables (at 95% confidence level). Thus, we conclude that non-response biases do not appear to be a major problem in this study.

## **4. Results**

### **4.1 The relationship between new product strategy and performance**

Table 1 shows the number of new product strategy chosen by the sample frame. It reveals that 35.6% of the respondents claim to use a highly innovative strategy for their new products, and 34.5% identify themselves adopting a moderately innovative strategy. Only 29.9% involved low innovative products. These results present current trend of new product strategy chosen by high-technology firms,

and are as expected since it is consistent with the contemporary thought that the higher innovation level can bring high rewards (O'Connor, 1998; Song and Monoty-Weiss, 1998; Kotabe, 1990).

To examine all grouping possibilities, a reasonable clusters-hierarchical clustering technique was employed without having to look at all configurations. In this paper, we grouped the samples into two groups: high-performance group and low-performance group in terms of the scores of NPD performance. Data about the relationship between new product strategy and performance are presented in table 2. The result indicates that low innovative strategy (88.5%) is more likely to have higher performance than either highly innovative strategy (80.6%) or moderately innovative strategy (73.3%). Moderately innovative strategy (26.7%) is more likely to have lower performance than either highly innovative strategy (19.4%) or low innovative strategy (11.5%). It is worth noting that these differences are not statistically significant. Therefore, this finding may support Schnaars's (1886) and Robinson et al.'s (1992) assertions that no one timing strategy is best. Furthermore, these results seem to imply that it is effective for firms no matter what they employ any new product strategy. It may be, as Robinson et al.'s (1992) have argued, that performance depends more on the skills and resources of the firm and their fit with market success requirement.

**Table 1:** The Number of New Product Strategy

	N	Percent
Highly innovative strategy	31	35.6%
Moderately innovative strategy	30	34.5%
Low innovative strategy	26	29.9%
N=87		

**Table 2:** New Product Strategy Choice and Performance

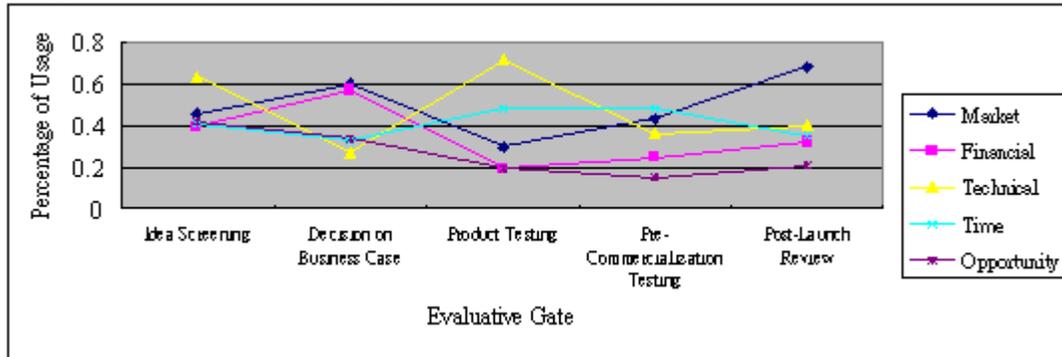
	Performance	
	High	Low
Highly innovative strategy	80.6%	19.4%
Moderately innovative strategy	73.3%	26.7%
Low innovative strategy	88.5%	11.5%

#### 4.2 The pattern of usage of evaluative categories under different new product strategies

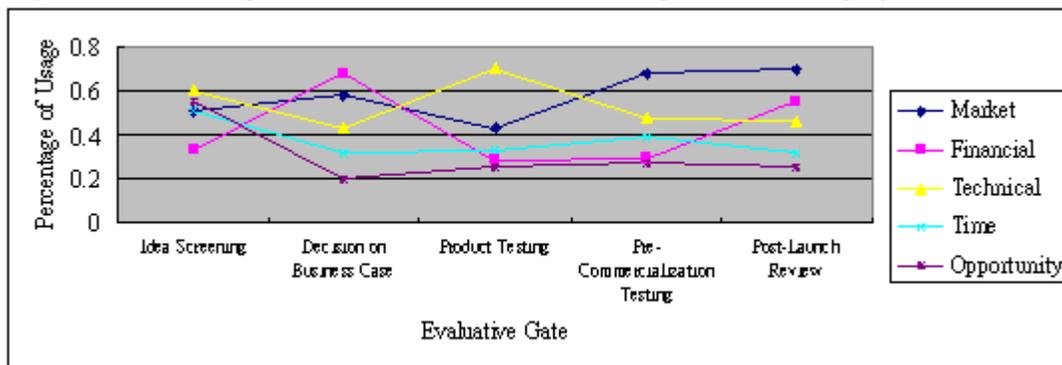
Figure 1 to figure 3 presents the patterns of usage of each evaluative category over the NPD evaluative gates under three types of innovative strategies: highly, moderately and low. The graphical results indicate that no matter what the firms use highly, moderately, or low innovative strategy, the pattern of usage of each evaluative category seems to be similar, although the degree of usage is different under three new product strategies. Market category is used most frequently at the idea screening, decision on business case, and post-launch review gates. This is consistent with Henard and Szymanski's (2001) studies arguing that market-related criteria as decisive aspects of go/no-go decisions made early on the NPD process, with Tzokas et al.'s (2004) results that market acceptance is highly used at the decision on business case gate, and with Griffin and Page's (1993) findings that sales and market share are two frequently employed measures to evaluate new product performance after launch.

Then, financial category is laid weight on the decision on business case gate and post-launch review gate. It also supports Tzokas et al.'s (2004) researches that margin and ROI measures were extensively employed at the decision on business case gate. And financial measures are also commonly used to evaluate new products at the post-launch review (Griffin and Page's, 1993). And technical category prominently takes over at the idea screening and product testing gates. This is in keeping with findings from the study of Tzokas et al. (2004). Technical feasibility and product uniqueness play important roles at the idea screening stage; product performance, quality and technical feasibility are

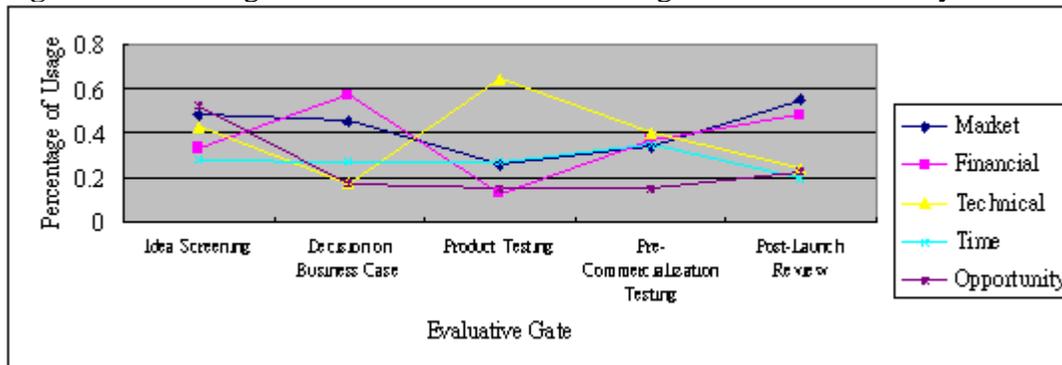
critical at the product testing gate. Interesting, the study reveals that the firms hardly employed time category and opportunity category. These results support Tzokas et al.'s (2004) study.



**Figure 1:** Percentage of Criteria in Evaluative Categories with Highly Innovative Strategy



**Figure 2:** Percentage of Criteria in Evaluative Categories with Moderately Innovative Strategy



**Figure 3:** Percentage of Criteria in Evaluative Categories with Low Innovative Strategy

### 4.3 Frequently used criteria at each evaluative gate under new product strategies

Table 3 shows the results that what evaluative criteria are frequently used at each evaluative gate of the NPD process under different new product strategies. Below, we will discuss the three most frequently used criteria at the different NPD evaluative gates under three types of new products.

In the initial screening gate, market potential, technical feasibility, and product uniqueness are the frequently used criteria in the three product strategies. No doubt, at this gate the Manager hopes to choose a right idea for further NPD. It is clear that a qualified idea should be feasible and desirable from technical and market conditions. Our research presents an appropriate result that combined technical and market views.

In the decision on business case gate, the Manager would decide whether to advance a development of new product. A detailed, formal analysis regarding financial conditions can convince

the firm to invest necessary resource to develop new products. Highly innovative products potentially entail great rewards for companies, thus, the criteria with regard to financial level are the most important evaluative prospect. Accordingly, this research indicates that the firms with the highly innovative strategy use sales volume, profit objectives, and sales objectives to assess; profit objective, sales objectives, and internal rate of return are the criteria most frequently used in the firms with moderately innovative strategy; those with low innovativeness use three frequently used criterion: profit objectives, sales volume, and margin rate.

In the product testing gate, the Managers need to examine the design and manufacturing of prototypes in order to ensure the functionality of the product from internal technical and manufacturing requirements. Thus, without doubt, results indicate that firms with any kind of product strategies use criteria most frequently at this gate are quality, technical feasibility, and product performance.

In the pre-commercialization testing gate the prototype is provided to its potential customers to test whether it has market potential. The Managers expect to obtain responses for market, technical and process aspects of the product. The mainly most frequently used criteria at this gate are customer satisfaction as well as customer acceptance and quality. In addition, in order to stand on first-mover position, the firm with highly innovative strategy also evaluate the criterion, time-to-market, extensively. By getting useful suggestions, the firm can continue further improvement, and then proceed to the next stage of the NPD process.

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In the post-launch review gate, the criteria most frequently used include market-related and financial-related consideration. It is obviously clear that the evaluative criteria are shifted from initial screening gate to now; the firms are prone to use customer, sales and profit levels to assess instead of technical levels. It is logical, as in this gate, the Managers attempt to understand whether the new product is accepted or satisfied by the customers, and whether there has any substantial feedback derived from the new product. Therefore, the most frequently used criteria in the firms with highly innovative strategy are customer satisfaction, market share and profit objectives. Customer satisfaction, market share and internal rate of return are the criteria most frequently used in the firms with moderately innovative strategy. The firms with low innovative strategy use three frequently used criteria: customer acceptance, sales volume and sales growth

**Table 3:** The Frequently Used Criteria at Each Evaluative Gate under Three New Product Strategies

Product Strategy Evaluative Gate	Pro Rank	Highly Innovative Strategy	Moderately Innovative Strategy	Low Innovative Strategy
		critterion	critterion	critterion
Initial screening	1	Market potential	Market potential	Product uniqueness
	2	Technical feasibility	Technical feasibility	Market potential
	3	Product uniqueness	Product uniqueness	Technical feasibility
Decision on business case	1	Sales volume	Profit objectives	Profit objectives
	2	Profit objectives	Sales objectives	Sales volume
	3	Sales objectives	Internal rate of return	Margin rate

Product testing	1	Quality	Quality	Quality
	2	Technical feasibility	Technical feasibility	Technical feasibility
	3	Product performance	Product performance	Product performance
Pre-commercialization testing	1	Customer satisfaction	Customer satisfaction	Quality
	2	Time-to-market	Customer acceptance	Customer satisfaction
	3	Customer acceptance	Quality	Customer acceptance
Post-launch review	1	Customer satisfaction	Customer satisfaction	Customer acceptance
	2	Market share	Market share	Sales volume
	3	Profit objectives	Internal rate of return	Sales growth

## 5. Discussion

This paper aims to three purposes. First, it examines the relationship between new product strategy and NPD performance. Second, it explores the patterns of usage of evaluative categories over NPD evaluative gates under three types of new product strategies: highly innovative strategy, moderately innovative strategy and low innovative strategy. And finally it tends to provide a complete picture of employment of evaluative criteria at each gate during the NPD process under given strategy conditions. By doing so, we make three significant contributions to the literature.

First of all, our findings indicate that any new product strategy can be effective, thus no one strategy is better than another. Moreover, our study finds the patterns of usage in evaluative categories. The similarities that were found in this study across new product strategies may demonstrate the stability of the findings. Market category is used most frequently at the idea screening, decision on business case and post-launch review gates; financial category shrinking appears on the decision on business case and post-launch review gates; technical category figures noticeable in the idea screening and product testing gates; time category and opportunity category are rarely emerged in the ranked list. In addition, the most frequently used criteria at the NPD evaluative gates alongside various new product strategies are presented in table 3.

Several Managerial implications can be drawn from this study. First, no one new product strategy is the best, therefore Managers should devote more energy to other critical factors such as the skills, resources, corporate goals and capabilities, rather than on strategy itself. Further, the referenced information related to a sample of successful new products, accordingly, the findings provide Managers better understanding of what evaluative categories are used along the NPD process, and how evaluative criteria are employed at each gate. Managers should follow, compare and contrast the results with their own NPD strategies to navigate the new product process.

There are several directions in need of urgent attention. First, the small scale of the study limits general applicability of the findings, future research, therefore, should undertake a large-scale survey to strengthen the generalizability of the results. Moreover, not all evaluative criteria are included in this study, there is possible for developing a more detailed list of criteria, such as customer participation, supplier involvement, business image etc. Finally, our research explores research questions in certain condition: new product strategy, following works could investigate whether the employment of criteria at each gate varies with situational (i.e. organizational structure) and environmental (i.e. industry) conditions.

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**Appendix 1: The Dimensions and Indicators of NPD Gates**

Scholar	Dimensions	Indicators
Ronkainen (1985)	Product	Exclusivity, performance/feasibility, ease of service, legality, organizational support, and safety
	Market	Size, growth rate, relation to present product lines, expected competitive situation, distribution characteristics, and special political and social factors

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	Finance	ROI, effect on cash flow, total investment requirement, and payback
Hauser and Zettelmeyer (1997)	Strategic goals	Match to organization's strategic objectives, scope of the technology, effectiveness of a new system, counts of innovations, patents, refereed papers, competitive response
	Quality/value	Quality of the research, peer review or research, benchmarking comparable research activities, gate success of concepts, percent of goal fulfillment, yield
	People	Quality of the people, Managerial involvement
	Process	Productivity, timely response, internal process measures, deliverables delivered, fulfillment of technical specifications, time for completion, speed of getting technology into new products, time to market, time of response to customer problems
	Customer	Relevance, customer satisfaction, service quality, number of customers who found faults
	Revenues/costs	Revenue of new product in 3 years/R&D cost, Percent revenues derived from 3-5 year-old-products, gross margin on new products, economic value added, bread-even after release, cost of committing further, overhead cost of research
	Tzokas et al. (2004)	Market-based
Financial-based		Bread-even time, profit objectives, IRR/ROI, margin
Product-based		Product performance, quality, product uniqueness, technical feasibility
Process-based		Stay within budget, introduced in time, time-to-market
Pilar et al.'s work (2004)	Intuition-based	Marketing change, intuition
	Technical feasibility	Project total cost for a given time objective, leverage of firm's R&D/technical resources, availability of resources
	Strategic fit	Alignment with firm's strategy, window of opportunity
	Customer acceptance	Market acceptance, customer satisfaction, product quality
	Financial performance	Margin rate, internal rate of return, sales volume
	Market opportunity	Long-term sales growth, market share

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