Navigating the new product development process

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Abstract

The quest for success in new product development (NPD) requires management to navigate complex processes. This study presents empirical evidence of the evaluative criteria used by well-experienced NPD managers from the UK and the Netherlands to control performance at different gates of the NPD process. The emerging usage patterns suggest that these criteria are aligned to the specific requirements of each stage in the process. This allows for detection of problems and initiation of adjustments that increase the chance for overall success of the new product. Based on these findings, recommendations are provided for managers to safeguard strategically the performance of their NPD efforts.

Keywords: NPD gates; Evaluation criteria; Weights

1. Introduction

Development and launch of successful new products is one of the most critical yet, most challenging tasks managers face. From a strategic point of view, new products well attuned to the voice of the customer, with perceived technical superiority, developed within budget and launched ahead of the competition provide real competitive advantages for the firm (Calantone & Cooper, 1979; Cooper & Kleinschmidt, 1987; Crawford, 1994; Hultink, Griffin, Hart, & Robbenm, 1997). Consider the case of the bagless vacuum cleaner developed and launched by Dyson in the UK. This new product was introduced into a mature industry dominated by large multinational firms that had lost touch with the customer, failed to detect the customers’ need for change, and, having dismissed the product idea as lacking any technical superiority, paid the penalty. The new product rejuvenated the whole industry by redefining the market game, driving it away from areas where the dominance of competitors was incontestable, e.g., cost and price.

This is easy to say but hard to put into practice. Although success stories receive wide publicity, the bold reality is that very few new products succeed in the market (Tribune Business News, 2001; Wall Street Journal, 1992). There is no doubt that for managers to increase the success rate of their new product efforts, they should master techniques for the planning, development, deployment, evaluation and control of necessary competencies throughout the new product development (NPD) process, i.e., from the generation of the new idea to the launch of the product in the marketplace. To do so, they need to align their new product strategy with their corporate strategy and secure the focusing of their NPD processes to the strategic imperatives of the firm.

Research over the past 30 years has shown that the NPD process is based on a series of development stages that are interpolated by a series of evaluative stages. These evaluation stages can be better understood as “gates” (Cooper, 1990) or “convergent points” (Hart & Baker, 1994) in that they can navigate managers to avoid go and no-go errors during the development process. Within each evaluation gate, management uses prespecified criteria to assess whether different tasks have been performed efficiently and effectively. These criteria act as “guideposts” against which the performance of the NPD effort can be evaluated and adjustments made, if necessary. To the extent that these guideposts are derived from the corporate and new product
strategy of the firm and are focused to the specific requirements of each stage of the NPD process, they can help reduce managerial uncertainty and identify areas where additional attention and resources are needed. Furthermore, they can inform the strategic decision making process of the firm as they can assist management to plan what competencies and resources to develop and deploy throughout the NPD effort.

In spite of the logical appeal of these evaluative criteria for the scientific management of the NPD activities of the firm, managers, wishing to employ the best guideposts for navigating the NPD process, will find little help in the relevant literature. The aim of this article is to address this gap in research. The research questions driving the study are as follows:

1. Which evaluation gates are perceived most important for the eventual success of new products?
2. How do firms use different guideposts alongside the various gates of their NPD processes?

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<thead>
<tr>
<th>DEVELOPMENT STAGES</th>
<th>EVALUATION GATES</th>
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<td>Concept Development: The product idea is drafted in verbal or pictorial form, further explaining the nature of the concept, with initial ideas of ingredients, materials &amp; technologies.</td>
<td>Concept testing: After interpreting the reactions from potential customers, it is decided whether the product concept has market potential</td>
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<tr>
<td>Build Business Case: A thorough market, technical and financial analysis takes place,</td>
<td>Business Analysis: Here it is decided whether the product is technically feasible, has market potential and will make a sound financial contribution to the firm</td>
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<tr>
<td>Product Development: The design and manufacturing of several prototypes.</td>
<td>Product Testing (functional): Here it is verified whether the prototype meets internal technical &amp; manufacturing requirements.</td>
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<td>Market Testing: The working prototype is tested with potential customers to assess their reactions.</td>
<td>Analyze Test Market Results: Here it is decided whether the prototype has market potential.</td>
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<td>Market Launch: The launch of the new product on to the market.</td>
<td>Post-launch Evaluation (Short Term): The success of the new product in the market is assessed when 25% of the lifetime of the product in the market has passed.</td>
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<td>Post-launch Evaluation (Long term): The success of the new product in the market is assessed when 75% of the lifetime of the product in the market has passed.</td>
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Fig. 1. Development stages and evaluation gates in the NPD process.
2. New product development process

The NPD process is guided by the new product strategy that aims to align the NPD efforts of the firm with its strategic imperatives. This alignment warrants that the new products planned will support the strategic objectives of the firm and make the best use of its strategic competencies. As it is illustrated in Fig. 1, the development stages of the NPD process include the generation of new product ideas, the development of an initial product concept, an assessment of its business attractiveness, the actual development of the product, testing it within the market, and the actual launch of the product in the marketplace. Alongside each of these stages, an evaluation takes place, essentially to determine whether the new product should advance further or be terminated.

During each evaluation, management may make use of numerous techniques to develop commercially and technically feasible designs of product configurations. However, as was stated earlier, although normative guidelines exist to help the development of the new product configurations, the criteria used to evaluate performance at different evaluation gates of the NPD process are sketchy (Hart, Hultink, Tzokas, & Commandeur, 2003). More specifically, it has been noticed in the past that “A major issue that has been overlooked is whether or not the same set of criteria is used at every decision-making point or whether the weights of individual criteria vary from one point to another” (Ronkainen, 1985).

As the performance of the NPD efforts of the firm has several dimensions, including technical, financial and market-based performance (Cooper & de Brentani, 1984; Craig & Hart, 1992; Hart, 1993), it is logical to assume that the evaluative criteria used in the gates should reflect these dimensions. Based on this premise, insights were borrowed from the general NPD performance literature, which although describes the multifaceted nature of new product performance after launch, has not addressed how the developmental evaluation of new products is geared toward the attainment of different performance outcomes. As such, a list was created of 20 evaluative criteria, which are illustrated in Table 1. They include the 15 core project-level criteria used by researchers in the past investigating new product performance, however, only after the launch of the product in the marketplace (Balachandra, 1984; Griffin & Page, 1993, 1996). As this study was focused on the evaluation of performance throughout the NPD process, an additional set of five criteria that are used in earlier gates of the NPD process were identified (Craig & Hart, 1992; Cooper & de Brentani, 1984; Hart, 1993; Ronkainen, 1985). Overall, these evaluative criteria were grouped under five dimensions, namely, market-, financial-, product-, process-, and intuition-based (see Table 1).

3. Method

We collected the data for this study by means of a survey with a large number of managers from UK and Dutch companies developing and manufacturing industrial and consumer goods. The survey included a mail questionnaire (in English and Dutch) that was extensively pretested with managers. It was addressed to the NPD director of each firm and sought information on the criteria that their companies use at various evaluation gates of their NPD processes. After two waves of questionnaires, 234 usable surveys were returned for a combined satisfactory response rate of 39.5%. Of these, 166 surveys were from industrial goods developers and 68 from developers of consumer goods. To obtain a homogeneous sample of respondents, it was decided to include in the analysis only the responses from industrial goods developers. The decision to elicit responses from two countries aimed at revealing any major differences in their use of evaluation criteria that could be attributed to cultural differences. As the results from the two countries were remarkably similar, the discussion is developed on the aggregated results.

Table 2 illustrates the demographic characteristics of the 166 industrial respondents and their firms. Respondents to this survey are highly experienced. Sixty percent of the respondents had been with the company for more than 5 years, while only 22% had been with the company for less than 3 years. This increases the value of the findings as they reflect the accumulated knowledge and established practice of well-experienced new product developers. More than half the respondents (52%) viewed their company as a technological innovator, 33% were perceived fast imitators, and 16% perceived their company as a cost reducer. In most companies (79%), customer needs are the basis for all new products developed; only 21% of the companies were technology-driven. This is also reflected in the fact that the
majority of the new products, commonly developed by firms in the sample, involved improvements of existing ones (64%). Only 12% of the products were characterized as completely new and another 23% as line additions. Finally, more than half (52%) of the companies ranked 2–4 in terms of market share in their served market, 29% of the respondents worked for a firm that is the market leader, while 19% of the respondents are employed in companies that rank 5 or lower in market share. Overall, it seems that companies in the sample have an innovative character, which in the majority of the cases is used to improve existing products so as to satisfy the needs of the customers better than competitive products.

4. Importance of evaluation gates for the eventual success of the new product

NPD managers were asked how important they thought each evaluation gate was for the success of their new products. For this reason, a scale from 1 to 7 was used, where 1 is unimportant and 7 is extremely important. Table 3 presents the results.

Although all stages were deemed quite important, Friedman’s nonparametric rank order test\(^4\) indicated that the product testing and market testing gates were perceived as most important for eventual success of the new product. This is an important finding, as it contradicts existing literature that places more emphasis on the initial stages and gates of the NPD process, i.e., idea screening and concept testing (Wheelwright & Clark, 1994). This may be a direct result of the fact that the majority of the products developed by companies in the sample are improvements of existing ones (see Table 2). Therefore, as the product idea and concept are already established, attention is diverted to the product and market testing of the improved product. Thus, it allows firms to make the best use of accumulated competencies and knowledge about the market, product, and customer needs. The usefulness of this finding can be assessed if one considers that the majority of the new products offered in the marketplace are in fact improvements of existing ones.

However, this is not to say that tasks to be performed are easier. Although these products are improvements of existing ones, often they necessitate changes to a number of areas within the firm, i.e., production equipment and scheduling, raw materials handling, quality testing, technical skill and servicing of the product in the marketplace, among other. There is a danger here that familiarity of the firm with the product and market may reduce managerial attention to the above things. This may lead to “technical dogs” (Cooper, 1979), which, if undetected, will place considerable strain to the firm’s resources later. It is important, therefore, for management to ascertain that the firm has in place the necessary resources and competencies for the successful performance of these tasks. This outlines the importance placed upon the product testing evaluation gate. Similarly, management needs to safeguard that these products are not simply “better mousetraps nobody wants” (Cooper, 1979). Much too often, the enthusiasm for the technical improvement of an existing product is not shared by customers in the marketplace, either because the improvement is too little to notice and its immediate benefit for the customer not apparent or because changes necessary to accommodate the improved product outweigh any perceived benefits. To account for these changes and

\(^4\) \(\chi^2(6) = 57.69, p < .000.\)
communicate the benefits to the customer base, management needs first-hand knowledge of how the product is perceived by potential customers. The market test gate allows management to test customer reactions while the product is in use by them. This helps identify any problems with the use of the product and plan communication campaigns alongside the real benefits customers perceive. Having passed this test, the product can then be launched in the marketplace.

5. The use of guideposts alongside the evaluation gates of the NPD process

For managers who said that they evaluated the new product in a certain gate, the percentage of those firms that used any of the 20 evaluation criteria was calculated. Table 4 shows the results from this analysis. Shadowed boxes indicate cases where a criterion is used by more than 50% of the firms in the sample, pointing out what one could accept as the most frequently used NPD evaluation criteria.

As it can be seen from Table 4, a pattern is beginning to emerge with regard to what evaluation criteria are used in each evaluation gate of the NPD process.

More specifically, in the idea screening gate, the technical feasibility and uniqueness of the product idea alongside the market potential and perceived customer acceptance are assessed. It is clear that at this gate management wants to make sure that only the “right” ideas are chosen for further exploration. Indeed, the major risk of this stage is that product ideas are chosen for further exploration despite being technically nonfeasible and unattractive to the market. Spending resources to develop an idea into products, only to learn later that the necessary skills are absent or that customers are unmoved by the proposition cannot be a sustainable approach to NPD. Although some “wild” ideas may well give rise to radical innovations, management’s role is to strike a balance between what is desirable and what is feasible both in technical and market terms. The experience from a number of companies suggests that ideas, which do not fit these criteria at this early stage of the development process, are kept aside waiting technical and market conditions to mature for future development (Cooker, 1986). However, as at this stage in the NPD process it is difficult for management to have precise information about market responses and technical requirements, they also have to rely on “intuition” for making a judgment. This is also reflected in Table 4, where intuition is one of the criteria most commonly used at the idea-screening gate by firms in this study.

In the concept-testing gate, the verbal and/or pictorial form of the product idea is evaluated to assess its market potential. Results show that management evaluates customer acceptance and technical feasibility to decide whether to proceed with a formal business analysis of the product concept. The high-use frequency of the technical feasibility criterion here is expected, as the detailed concept description of the product idea allows management to collect and assess more information with regard to its technical requirements.

In the business analysis gate, the product idea has undergone a detailed, corporate wide analysis with regard to its technical, market, and financial prospects. Management needs to decide whether to go on with the actual development of the product. This is a critical decision as it denotes the commitment of substantial resources to a project. The analysis suggests that the criteria most frequently used at this gate aim to establish whether the product will meet the sales objectives, sales in units, margin, and profit objectives set by management. As market potential influences all these objectives for the product in question, it also becomes a frequently used criterion. It is

<table>
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<th>NPD evaluation gates</th>
<th>Evaluation criteria</th>
<th>Financial-based</th>
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<th>Intuition-based</th>
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<td>Market-based</td>
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<td>Idea screening</td>
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<td>Customer satisfaction</td>
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<td>Sales growth</td>
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<td>Market share</td>
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<td>Market potential</td>
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<td>49</td>
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<td></td>
<td>Break-even time</td>
<td>37</td>
<td>56</td>
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Where: ☑ Over 50% of the companies in the sample make use of the criterion at this gate.
important to notice that criteria used at this stage reflect the financial issues surrounding the new product rather than its technical considerations. This is logical if one considers that at this gate the new product needs to gain corporate wide endorsement and justify its attractiveness against competitive requests on resources.

In the product testing gate, management needs to ascertain that the product has been developed according to specifications set. The most frequently used criteria here refer to the quality, the performance of the new product, and its technical feasibility. Results indicate that management also evaluates whether the product development effort has stayed within the budget allocated for the project. This is important in the sense that deviations from the initial budget may reduce the resources available for the eventual launch of the product. In addition, such deviations may direct management to reconsider some of the previously set profit and margin objectives to recover any unanticipated expenditure.

In the test market gate, the prototype of the product has been made available to its potential customers to evaluate. Here, it is critical to assess customers’ reactions to the product and its performance when it becomes part of the customers’ production process. This provides management with the opportunity to detect any problems from the compatibility of the new product with the existing systems of potential customers. The most frequently used criteria here are the performance and quality of the product and customer acceptance and satisfaction. Confirmation that the product scores well on these criteria allows management to proceed launching the product in the marketplace with greater confidence for its eventual success.

In the short-term, postlaunch gate, it is imperative for managers to assess whether the product is performing according to their expectations in the marketplace. Evaluation in the short term is critical for allowing the detection of any problems before they adversely affect the product line or the corporate image as a whole. The criteria most frequently considered by management include customer acceptance and satisfaction, margin, and sales in units. The range of the criteria used here denotes management’s efforts to ascertain the performance of the product on multiple dimensions.

In the long-term, postlaunch gate, the evaluation criteria used include margin and sales in units sold. This denotes a shift in attention from the technical performance of the product to its contribution to profits and sales. Again, this is logical, as in the long term, the product is well established in the marketplace and its product performance verified. Yet, another criterion used here is the customer satisfaction with the product. In the long term, it is possible that changes in customer expectations may affect their perceived satisfaction with the product (Woodruff, 1997). This, it can be argued, explains management’s consideration of customer satisfaction in the long term as it assists them to detect such changes, which if surpassed may undermine the product’s appeal to the customer base.

Overall, the above results suggest that firms use different criteria for evaluating performance at different gates of the NPD process. These differences reflect the different managerial tasks that need to be performed successfully at each stage of the NPD process so as to warrant the overall success of the product.

To gain a better understanding of variations in the use of criteria along the NPD process a further higher level of analysis was used. The standardized number of criteria per dimension used in each evaluation gate was assessed (i.e., number of criteria per dimension used, divided by the
initial number of criteria in each dimensions, see Table 2) and their usage over the NPD process compared. Fig. 2 provides a graphical representation of the results of this analysis.

Patterns of usage in Fig. 2 corroborate earlier findings. In addition, they show that the usage of market-based criteria is consistently higher than financial criteria in every evaluation gate apart from the “business analysis.” However, previous research (Ronkainen, 1985) found that the usage of financial criteria is greater than that of market-based criteria. These different findings may suggest that firms in this study have embraced the message that a clear market orientation should guide the whole activity of the firm, and hence, the whole NPD and efforts expended therein. After all, it is during the last decade that the concept of market orientation has gained prominence in the marketing discipline, and therefore one would expect a higher awareness of the concept, if not more rigorous attempts to apply it in contemporary firms.

6. Managerial implications

There is no doubt that success in NPD requires the simultaneous mastery of seemingly contradictory or paradoxical organizational and strategic skills. They include, among other, decisiveness, broad vision and attention to detail, bold moves and incremental adjustments, customer orientation and attention to competitive moves, timely NPD, and completion of all the key activities in the NPD process. However, it is in this increased complexity of the NPD process where enterprising management thrives. By anchoring their strategic moves and operational procedures to well-established guideposts, they can navigate successfully the NPD process.

This study sought to investigate how experienced industrial new product developers navigate their NPD processes. However, it must be made clear that no attempt was made to examine the influence of these navigating practices upon new product performance. Due to a lack of research in this area, the research team was content with examining what guideposts experienced developers used. Yet, the level of experience of managers participating in the study and the good market position of their firms increase confidence in the thesis that what they do should be carefully considered by other firms too.

The emerging guidelines for NPD managers are as follows:

- **Develop new product strategies and NPD processes that are well anchored to the performance criteria used in each NPD evaluation gate.** This can be achieved by planning the development of competencies and mobilization of resources in accordance with the requirements for attaining success at each stage/gate of the NPD process. Overall success can be warranted only when each individual stage of the NPD process has been performed successfully.

- **Pay attention to all the evaluation gates of the NPD process.** When dealing with the introduction of improvements of existing products, pay additional attention to the product and market evaluation gates. This will reduce the risk of overseeing problems emerging from overconfidence when managing the improvement of an existing product.

- **Maintain an overall market orientation in the NPD process.** To this end, customer acceptance and customer satisfaction should be used as evaluative criteria that permeate the whole NPD process. This will allow managers to listen to the “voice of the customer” in a systematic and coherent way alongside the whole spectrum of their NPD efforts.

- **Keep tracking the product performance in the long term.** In the long term, customer expectations change and therefore their perceptions of the value they get from a product may change as well. Tracking customer satisfaction in the long term will allow the firm to decide whether the product needs additional support, a rejuvenating injection of capital, technical upgrade, or a strategy of deletion to give way to other products or release resources for other NPDs.

Furthermore, it is suggested that rigorous documentation and reference to the evaluation results of a series of NPD projects will promote the necessary learning for avoiding traps and exploiting unforeseen opportunities. Documentation of the evaluation results will allow management to compare and contrast historical results of their NPD processes with their ensuing performance. As such, management can compare the efficiency and effectiveness of their navigating procedures within NPD projects with different degrees of newness and under different environmental conditions. This will allow for the encoding and retrieval of any tacit knowledge historically developed from the NPD efforts of the firm. In addition, firm-wide consensus is necessary, since implementation of the evaluation criteria may create an internal market that can give rise to political tensions among the groups involved in the joint NPD effort. Given this consensus, internal market conditions will assist managers in their effort to maintain a high level of quality in the execution of the different tasks throughout the NPD process.

Overall, the aggregated results from experienced new product developers have helped to gain a better understanding of how new product processes are navigated. As stated earlier, there is value in research examining how these navigating routes impact the final performance of the new product. In addition, as the vast majority of the products developed by firms in this study were improvements of existing ones, more research is needed to examine whether firms dealing mainly with the development of completely new products make different use of these or other evaluative
criteria at the various stages of their NPD processes. These are critical research directions that are in need of urgent attention.

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