A Cost/Time Trade-off Framework for New Product Development

Julie H. Hertenstein and Marjorie B. Platt

EXECUTIVE SUMMARY

- To ensure that new products will compete effectively in the marketplace, most *new product development* (NPD) teams establish a target price for a new product. To ensure new products reach the market in a timely manner, NPD teams also stipulate that a target date for a product introduction, thereby defining the "time-to-market" for product development.
- Ideally, an NPD team will be able to achieve both target cost and time-to-market goals. However, situations can arise in which the team is forced to trade off one goal against another.
- This article presents a framework to enable NPD teams to trade off the financial implications of time required to redesign a product to achieve a target cost versus the financial ramifications of proceeding with a market launch without redesigning a product that exceeds its target cost.
- The framework includes four basic factors: the product cost overrun, the firm's expected gross margin, the time required to redesign the product, and the amount the firm is penalized for being "late to market." Managers can change the magnitude of the factors to fit their individual situations.

To ensure that new products will succeed, most new product development (NPD) teams establish targets for the price point at which the new product will be sold. From this target market price, the NPD team establishes a *target cost* for the product (Cooper and Chew, 1996). To compete effectively, products must also reach the market in a timely manner, before they are leapfrogged by competitors. Therefore, NPD teams often stipulate a desired deadline for product introduction, or launch, which defines the time-to-market for product development.

Ideally, NPD will be able to achieve both target cost and time-to-market goals simultaneously. However, situations can arise in which the team is forced to trade off one goal against another. These cost/time trade-offs are illustrated here through the statements of individuals engaged in NPD at two firms, Durable Company and Components Company. As their statements show, corporate strategies and priorities influence these trade-offs, thus producing different outcomes at the two firms.

Durable Company has a single line of business, making a durable product sold to businesses. Many of its clients are Fortune 500 companies. In the

Julie H. Hertenstein *and* ***Marjorie B. Platt*** *are associate professors in the College of Business Administration at Northeastern University in Boston, Massachusetts.* *The authors thank the Design Management Institute and its president Earl Powell, plus the managers at Components Company and Durable Company for their generous contributions to this article.*

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following quotations, a variety of managers from Durable describe the company's strategy and the importance of product cost among the key corporate priorities. These managers also discuss their typical responses when the estimated cost of the product they had designed exceeded the target cost established for that product. They reveal that at Durable, time typically won over product cost when they were forced to trade off cost versus time goals.

Durable Company

Finance Manager: Our competitive advantage comes from integrating our products into how people work in their daily lives. We combine knowledge and technology to integrate our products into functions people do daily to help them perform these functions better. We command a premium price because we offer smart products that help people function better. We are not the low-cost producer.

Marketing Representative: We are not a low-cost producer, so we build high value into our products.

NPD Manager: In terms of corporate priorities, ours are (1) quality, (2) timing, and (3) cost.

Manufacturing Engineer: I believe that the rank order would be (1) timing, (2) quality, (3) cost, and (4) safety of workers.

Finance Manager: Our company has eight key objectives; cost is in the middle.

We negotiate within the team that includes marketing, product engineering, industrial design, manufacturing engineering, and finance.

NPD Manager: If the design does not meet the target cost, we negotiate. For example, can the market take a higher price? Can we change aesthetics, which may increase or decrease cost? We negotiate within the team that includes marketing, product engineering, industrial design, manufacturing engineering, and finance.

Finance Manager: If the initial concept does not meet the target, we ask questions such as the following: Are you at the right price point? Are the features clearly defined? If the answer is yes, our confidence increases that the cost target is okay, and we brainstorm to reduce [the estimated] cost.

Manufacturing Engineer: When we attempt to reduce product costs, first we look to reduce labor, because labor drives overhead costs [Durable allocates all manufacturing overhead on the basis of direct labor.] Second, we look for versatile tooling, trying to minimize machines dedicated to a single product. Finally, we consider outsourcing, as the company applies a much lower burden rate for outsourced product versus in-house product.

Industrial Designer: If the estimated cost is greater than the target cost, we look for trade-offs. First, we consider whether there are too many parts. Then we have to figure out how to reduce labor on the product, because we have very high overhead multipliers for labor. Further, we will consider outsourcing, because outsourced parts carry a far lower multiplier than in-house produced parts. Finally, we look to changes in the manufacturing process, because a good manufacturing engineer can simplify assembly.

The problem with product cost reduction is time constraints. There is a trade-off between redesign and time-to-market. Time tends to win more than redesign.

NPD Manager: If we aren't meeting our cost target, our general response is that if the market needs the product so badly, the company will take a lower profit margin. For 75 to 80 percent of products in the last 10 years, time-to-market has been critical.

Finance Manager: The problem with product cost reduction is time constraints. There is a trade-off between redesign and time-to-market. Time tends to win more than redesign.

Components Company also has a single line of business; it makes components for durable consumer products produced by other companies. Components Company ranks product cost much higher than Durable Company does in its corporate priorities, because Components feels pressure from customers to keep costs low. Thus, at Components, concerns about meeting cost targets take precedence over time-to-market. If cost targets are not met, product introduction is often delayed while the NPD team works to achieve the product cost target, as illustrated next.

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Components Company

Controller: Our clients, the OEMs [original equipment manufacturers], are under pressure to keep their costs down. Hence, we must also focus on the cost aspect of our products.

Industrial Designer: Also, we are under "back pressure" from the plants to reduce costs and increase profit margins up front [in design and development] because operations in the plants cannot cut costs dramatically.

Industrial Designer: Having a well-designed product that satisfies [customer needs] is equal with cost and quality as goals. Each is part of a triad that supports each other part.

Controller: Cost is a major part of the discussion during product development. Even in very early idea stages, we work with rough cost estimates.

Industrial Designer: We get information from the marketing group, including competitive information. We need to have a good feel for the price point at which the product will sell. Then the first thing we do is to derive a target cost.

Industrial Designer: Cost is a creative constraint. If you know the cost [target] up front, it is liberating. Sometimes you get into trouble when you do "blue sky brainstorming" design; often the output cannot be used. Designers want to work on producing usable solutions, not ideas that are thrown away. How we get to the target cost is like fitting together puzzle pieces. We consider alternatives that invoke cost-competitive processes to help reduce cost. We [also] try to design in more value to increase the target cost.

Controller: Cost problems may be identified, as when a tooling engineer says, "it will be prohibitively expensive to manufacture that part using that process."

Industrial Designer: Constantly articulating assumptions helps teams to work in concert. And the process [of identifying the target cost up front] invites these conversations to happen sooner. That way, we don't get all the way through the development process before someone says, "Hey, that can't work!"

Industrial Designer: At the milestones, we look at quality, the product design features, and cost, then compare them to the baseline we targeted initially. We must meet these [baseline] points. If not, we will have to take the time to redesign the product until the baseline is achieved.

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Thus, at Durable, where cost has a lower strategic priority, when the target cost is exceeded the company considers cost-reduction possibilities (e.g., reduce direct labor or outsource components) but often proceeds without redesigning because time-to-market is considered critical. In contrast,

Components' managers consider product cost to be as important as other key goals. Not only do they address product cost continually throughout the NPD process, but if they fail to achieve their cost target, they typically take the time to redesign.

"New products have to be on time, on quality, and on cost if we . . . are to nurture the loyalty of our customers and end users."

Multiple Priorities

Facing multiple priorities is not uncommon in new product development. As Martin Gierke (1996), director of industrial design at Black and Decker, states: "New products have to be on time, on quality, and on cost if we . . . are to nurture the loyalty of our customers and end users." Thus, although product cost, quality, and time-to-market are goals that NPD teams need to achieve simultaneously, a problem that arises in one area may require a trade-off with other goals.

Today, NPD managers seem to agree that reducing quality is not a viable option open to NPD teams; that is, to compete effectively, quality is not negotiable. Thus, for most NPD teams presented with expected product cost overruns similar to those discussed previously by NPD personnel at Durable and Components, the trade-off decision focuses on cost versus time.

Corporate strategy and priorities provide useful guidelines to trade off cost versus time goals. However, in the event of a product cost overrun, the question remains whether it is *always* preferable for Durable to proceed without redesign, or whether Components should *always* take the time required to redesign to achieve the target cost. Analyzing the impact of these trade-off decisions requires understanding the financial implications of each alternative.

Development Costs vs. Product Costs

Several cost/time trade-off models have been presented in the literature. Before comparisons and conclusions can be drawn from these models, however, the exact definition of cost must be clarified. Most cost/time trade-off models focus on how *development* cost relates to the time to develop new products. Some write of the need for product designers to trade off time versus development cost goals (Cohen, Eliashberg, and Ho, 1996; Swink, Sandvig, and Mabert, 1996). Others have shown both theoretically and empirically that as firms accelerate the NPD process and reduce the time-to-market, development costs tend to rise exponentially (Graves, 1989; Mansfield, 1988).

An important issue is the distinction between product cost and development cost.

However, as indicated earlier, product designers involved with NPD activities also focus on *product* cost. Thus, an important issue is the distinction between product cost and development cost. Development cost consists of all project costs incurred during the NPD process–from advanced concept to product launch, just before the product moves into production. Typically, development costs include items such as compensation for the NPD team, prototypes, initial tooling, testing expenses, and initial market research. Although *total* development cost can be substantial, on a *per-unit* basis it often is far smaller than the unit product cost (e.g., development cost was $490 per vehicle for Chrysler in 1994) (Harbour, 1994).

Product cost, on the other hand, refers to all costs incurred in manufacturing the product. It typically includes the direct material, direct labor, and indirect or overhead expenses involved with production. The product cost structure is designed into the product before it enters the manufacturing stage (see sec-

tion "Why Product Cost Is Important"). Hence, once design is complete, the cost of a product is fairly predetermined; there are limited opportunities for cost reduction. Because product cost affects product profitability, often for years, NPD teams must attend to trade-offs between product cost and time-to-market.

Cost/Time Trade-off Models

One recent net profit model approximates the impact of cost, time, and performance overruns (Smith and Reinersten, 1991; 1998). Specifically, it models a 10 percent product cost overrun, a six-month delay in product introduction, a 50 percent development cost overrun, and a 10 percent sales performance shortfall. The model finds that, over a five-year horizon, the six-month delay in product introduction was the most costly. However, this result depends on a key assumption about product cost overruns that may not be viable: that the product cost overrun can be eliminated entirely in the production stage. Other research suggests that assuming that problems can be corrected in production can result in failure. In a study of innovative projects that were truly first-time efforts, Souder (1987) found that waiting to correct errors made during earlier stages in the development process often led to failure. In his words, "Don't let project errors ride. Don't wait to fix them in the plant or in the field" (Souder, 1987, p. 64).

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Thus, despite many models that address development cost overruns, only the Smith and Reinersten (1991, 1998) model addresses the product cost overrun issue, but only in a limited manner. More work is needed to better understand how product cost overruns and time-to-market factors relate and affect a firm's performance. Later we present a cost/time trade-off framework focused specifically on the effects of product cost overruns and delays in market introduction from the target launch date on the firm's profitability. The framework does not address the profitability effects of development cost overruns or accelerating the normal NPD process, which have been well addressed by prior literature.

Why Product Cost Is Important

It is well accepted that product cost, gross margin (the difference between a product's cost and its selling price), and the gross margin percentage to sales are frequently used financial yardsticks for evaluating manufacturing firms. Manufacturing firms struggle on a daily basis to reduce the cost of their products. Moreover, a key competitive strategy that a firm can select is to be a low-cost producer (Porter, 1980).

A key to controlling product cost is to focus on product cost during the NPD process (Hertenstein and Platt, 1998; Minahan, 1997). Several researchers have suggested that somewhere between 75 and 90 percent of total product costs are predetermined once product design is completed (Shields and Young, 1991; Berliner and Brimson, 1988). That such a high proportion of product cost is determined during design and development suggests that product development provides important opportunities for managing product costs. These opportunities may be relatively untapped compared to more traditional approaches to cost reduction, such as streamlining manufacturing processes or activities (Banker, Datar, Kekre, and Mukhopadhyay, 1990; Kaplan, 1990). Previous research has

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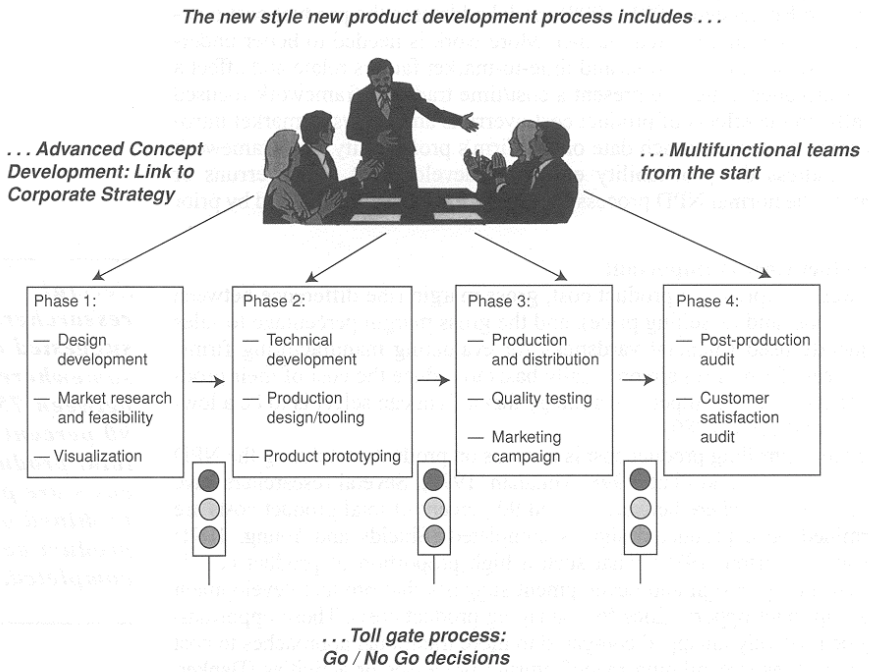
suggested that management accountants may have important, distinctive contributions to make to NPD through their understanding of the drivers and implications of product cost (Hertenstein and Platt, 1998).

Opportunities to focus on product cost exist throughout new product development, but many would argue that the best opportunities occur in early stages (Hertenstein and Platt, 1998; Minahan, 1997). The NPD process used by many manufacturing firms today involves a number of distinct phases. As Exhibit 1 shows, advanced concept discussions, stemming from the firm's strategy, generate product concepts that cross-functional teams design and develop into the final product design in phases. At "tollgates" between phases, senior managers reevaluate the project and decide whether or not to proceed with development. The process in Exhibit 1 is characteristic of the more advanced processes used to develop products and includes features that characterize firms most successful in NPD (Griffin, 1997).

Exhibit 1. The New Product Development Process



Product designers are well aware of the importance of product costs. Their awareness is heightened, in part, by the fact that most firms use product cost as one measure of product designers' performance. In a recent survey of industrial design managers involved with NPD, Hertenstein and Platt (1997) investigated which, if any, of 43 performance measures (16 financial and 27 nonfinancial) were used to evaluate design performance. They found that product cost was considered the most important financial performance measure for product designers, although it ranked slightly behind two nonfinancial performance measures: customer satisfaction with the product and customer satisfaction with its ease of use. In addition, design managers responded that even more emphasis should be placed on product cost as a performance measure than is currently placed on this measure, thus indicating their awareness of the importance of their contributions to achieving product cost objectives. A more recent report shows that NPD teams set target costs for new products, then use these cost targets to evaluate if the final product design achieves the product cost goals (Hertenstein and Platt, 1999).

Why Time-to-Market Is Important

Pressure on NPD managers to speed up new product introductions while reducing cost and maintaining or improving quality is often daunting. Accelerating the NPD process and thereby reducing time-to-market produces strategic and operational advantages including preempting competitors, setting standards for price and performance, increasing name recognition, and potentially earning initial monopoly profits from economies of scale (Zahra and Ellor, 1993).

"Speed is not the objective, it is the means to an end; the objective is making money."

Studies have suggested a variety of ways to reduce development time, including:

- Consistent implementation of a well-defined, phased NPD process;
- Use of cross-functional NPD teams;
- Use of computer-aided design tools; and
- Reducing product complexity and degree of innovativeness (Griffin, 1997; Ittner and Larcker, 1997).

However, some caution that a faster new product launch alone is not enough to ensure success (Ittner and Larcker, 1997; Smith and Reinersten, 1998). Rather, Smith and Reinersten (1998) observe that "speed is not the objective, it is the means to an end; the objective is making money" (p. 21).

THE COST/TIME TRADE-OFF FRAMEWORK: AN ANALYSIS

Because companies clearly make decisions trading off product cost targets against time-to-market constraints, the issue is whether the decision is well informed. When should even a time-sensitive company hold out to redesign a product to reduce product costs? And when should a company competing on the basis of cost plunge forward despite the fact it has not yet achieved its cost targets?

The model proposed by Smith and Reinersten (1998) can be extended to incorporate variations in expected gross margins, time delay penalties, magnitude of product cost overruns, and the number of months by which product

introduction is delayed. In doing so, the framework will better reflect the decision-making environment that product designers face.

We propose a framework that will enable a firm or manager to examine the financial implications of the time required to redesign a product to achieve the target cost versus the financial implications of proceeding without redesign. A systematic framework should identify *conditions* under which it may be reasonable to take the time to redesign or simply to proceed. Better understanding of these issues can guide a NPD team in selecting among design alternatives. In addition, it can help accounting managers deliver information needed by NPD teams to make these trade-offs.

Our framework considers two factors: the product cost overrun penalty and the delay penalty. Each factor is a function of two variables, as discussed in the next sections.

The Cost Overrun Penalty

The product cost overrun penalty, or the financial effect if the expected cost exceeds the target cost, is the amount that gross margin is reduced by exceeding the target cost. This can be expressed as a function of the following:

1. The percentage by which the expected product cost exceeds the target cost; and
2. The magnitude of the expected gross margin percentage.

***The issue is not merely* whether *the expected product cost exceeds the target cost but* whether and by how much.**

Magnitude of Product Cost Overrun

Beginning with the expected product cost overruns, the penalty to the company, in terms of lower gross margins, is greater if the expected product cost exceeds the target by 10 percent than if it exceeds the target by 1 percent. So the issue is not merely *whether* the expected product cost exceeds the target cost but *whether and by how much*. Product development teams typically calculate the estimated cost and compare it to the previously established target at the tollgate decision points between development phases, as discussed earlier. Thus, when product development teams and their management decide whether to redesign a product to achieve the target cost or to proceed, they know the amount by which the expected cost exceeds the target.

Expected Gross Margin

The magnitude of the expected gross margin also influences the magnitude of the impact of exceeding the target cost. The *smaller* the gross margin, the *greater* the percentage impact for a given percentage variance from target cost.

To illustrate, assume Product A and Product B have expected selling prices of $100 each and standard gross margins of 2 percent and 50 percent, respectively (see Panel A of Exhibit 2). Thus the target costs will be $98 and $50, respectively.

Now consider what happens if each product experiences a 1 percent product cost overrun. The expected cost for Product A becomes $98.98, and the expected cost for Product B becomes $50.50, as shown in Panel B. Note that this mere 1 percent product cost overrun cuts the gross margin of Product A, with its tiny 2 percent standard gross margin, nearly in half, while the gross margin of Product B, with its substantial 50 percent standard gross margin, falls by only 1 percentage point.

Thus, the magnitude of the gross margin suggests how much flexibility there is on product cost before the product is not financially feasible; the smaller the gross margin, the less variance from target cost (on a percentage basis) can be tolerated. Interviews with product development team members indicate that they know the expected gross margin for products they are developing. Awareness of the expected gross margin is reinforced by target costing, which derives from the targeted market-based price using the expected gross margin.

The Delay Penalty

The second factor in the framework, the delay penalty (i.e., reduction in gross margin caused by a delay in introducing a product) can be expressed as a function of the following:

1. The time required to redesign the product to achieve the target cost; and
2. The amount the company is penalized for a given delay if the product is late to market.

Length of Delay

The penalty to the company for lengthening (i.e., delaying) the time-to-market will generally be greater for a six-month delay than that for a one-month delay.

Exhibit 2. Comparative Changes in Gross Margin for a 1 Percent Increase in Product Cost

Panel A

Standard Gross Margin and Target Cost

	Product A	*Product B*
Expected Selling Price	$100	$100
Target Product Cost	98	50
Standard Gross Margin	$2	$50
Standard Gross Margin %	2%	50%

Panel B

Expected Product Cost Exceeds Target Cost By 1%

	Product A	*Product B*
Expected Selling Price	$100.00	$100.00
Target Product Cost	98.98	50.50
Standard Gross Margin	$1.02	$49.50
Standard Gross Margin %	1%	49%

Exhibit 3. The Cost of Arriving Late-to-Market (Yet Still on Budget)

If your company is late-to-market by:	6 months	5 months	4 months	3 months	2 months	1 month
Your gross profit potential is reduced by:	33%	25%	18%	12%	7%	3%

This exhibit is excerpted from Vesey 1991b, Table 1. Attempts to obtain the original unpublished study by McKinsey & Company were unsuccessful.

Interviews with product development team members suggest that they do not have well-grounded knowledge of the cost of delay.

Interviews with product development team members indicate they have well-formed expectations about how much time is required to redesign their products to achieve the target cost, once they know the cost overrun percentage. So the product development team can readily estimate the delay in time-to-market if it must redesign the product to achieve the target cost.

The Cost of Delay

On the other hand, interviews with product development team members suggest that they do not have well-grounded knowledge of the cost of delay. Smith and Reinersten (1998) reported a similar result. A review of the literature also indicates that few concrete data are available on this subject. To illustrate the framework, we initially use frequently quoted data from a McKinsey study (Dumaine, 1989; Vesey, 1991a, 1991b). The McKinsey results have been criticized because they were focused on the highly volatile high-tech market (Cooper, 1995; Crawford, 1992), so we also examine the implications under alternative assumptions. The cost of delaying market introduction is a critical issue that requires further study.

The McKinsey data, representing the reduction in gross margin for a given period by which a product is late to market, are presented in Exhibit 3. These penalties are not linear. Rather, they represent an escalating penalty for increasing delays. Specifically, the penalty for being two months late is more than twice the penalty for being one month late. Furthermore, these gross margin reductions apply over the lifetime of the product (Vesey, 1991b).

Analyzing Cost Overrun and Delay Penalties

Let us consider the combined impact of the four variables identified previously, beginning with the two variables related to the product cost overrun penalty. We begin by assuming that the planned gross margin is 25 percent; we will relax this assumption later. If the expected cost exceeds the target cost by the amounts indicated in Table A and the firm *does not delay to redesign* but proceeds to manufacture and sell the product with the higher cost, the firm's planned gross margin will be reduced by the percentages shown in the second line in Table A.

Table A
Product Cost Overrun Penalty for 25% Gross Margin

If the expected cost exceeds the target cost by:	1%	2%	3%	5%	10%
Gross margin will be reduced by:	3%	6%	9%	15%	30%

Next, we examine the delay penalty. Using the data from Exhibit 3, this cost is shown in Table B.

Table B
Delay Penalty

If the length of delay in months is:	1	2	3	4	5	6
Gross margin will be reduced by:	3%	7%	12%	18%	25%	33%

Thus, using Tables A and B, if expected cost exceeds target cost by 3 percent (penalty = 9 percent), and if the product can be redesigned to achieve the target cost within one or two months (penalty = 3 percent or 7 percent, respectively), a company would be better off financially to redesign the product. On the other hand, if three months or more would be required to redesign the product to meet the target cost, the company would be better off to plunge ahead without redesign, because the time delay will be more costly (penalty = 12 percent or more) to the firm than the product cost overrun (penalty = 9 percent). However, if expected cost exceeds the target cost by 1 percent, and it will take one month to redesign the product to achieve the target cost, the penalties are the same (3 percent); here, the company might as well proceed.

Varying Gross Margin Assumptions

Next, let us relax the assumption that the planned gross margin is 25 percent. Exhibit 4 shows the product cost overrun penalties at varied gross margins, given product cost overruns ranging from 1 percent to 10 percent.

According to the data in Exhibit 3, the penalty for a one-month delay is 3 percent. Thus, if *one month* is required to redesign a product to achieve the target cost, this delay is justified for all situations in which the product cost overrun penalty exceeds 3 percent. It is not justified if the product cost overrun penalty is less than 3 percent, and the company is indifferent about proceeding versus redesigning if the penalty equals 3 percent.

Exhibit 5 illustrates the situation for a one-month delay. Line A represents indifference between redesign requiring one month to achieve target cost and proceeding given the indicated product cost overrun. Thus, if one month is required to redesign the product to meet the target cost, redesigning the product is beneficial financially in all sets of product cost overrun and gross margin conditions represented by points *below and to the right of Line A*.

Exhibit 4. Cost-Time Trade-off* at Varied Gross Margins

	Planned Gross Margin				
Percentage of Cost Overrun	40%	35%	30%	25%	20%
1%	1	2	2	3	4
2%	3	4	5	6	8
3%	5	6	7	9	12
4%	6	7	9	12	16
5%	7	9	12	15	20
6%	9	11	14	18	24
7%	11	13	17	21	28
8%	12	15	19	24	32
9%	14	17	21	27	36
10%	15	19	24	30	40

* The cell figures which represent the percentage reduction in gross margin have been rounded for clarity of presentation.

Exhibit 5. One-Month Delay Trade-off at Varied Gross Margins

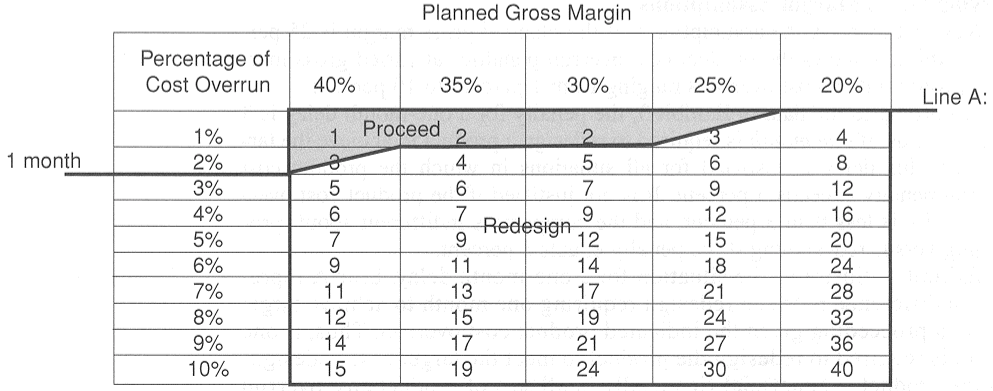
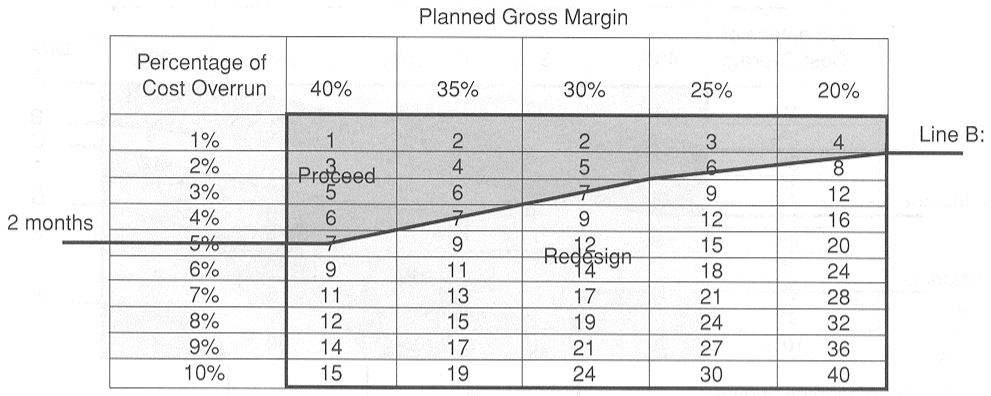


Exhibit 6. Two-Month Delay Trade-off at Varied Gross Margins



In Exhibit 6, Line B represents indifference between redesign requiring *two months* to achieve target cost and proceeding given the indicated product cost overrun. Thus, similar to the previous argument, if two months are required to redesign the product to meet the target, it is beneficial financially to redesign the product in all sets of product cost overrun and gross margin conditions represented by points *below and to the right of Line B*.

In Exhibit 7, Lines C, D, E, and F (which represent indifference lines for 3, 4, 5, and 6 months, respectively) are shown with Lines A and B. Points between Line A and Line B represent a zone in which one-month redesigns (but not two-month redesigns) are appropriate. Similarly, points between Line B and Line C represent a zone in which two-month redesigns (but not three-month redesigns) are appropriate. Note that as the time required to redesign the product gets longer, there are fewer conditions in which it is financially justified, exactly as you would expect.

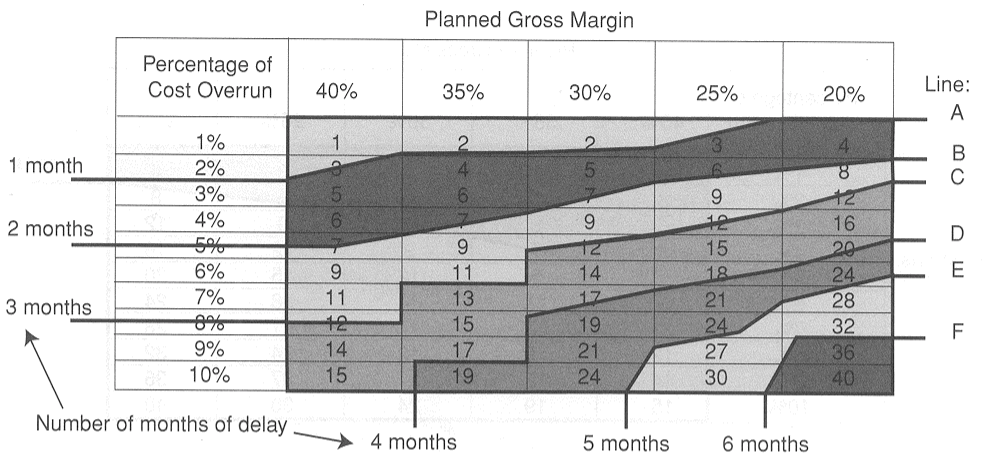
Note that as the time required to redesign the product gets longer, there are fewer conditions in which it is financially justified, exactly as you would expect.

Reducing the Penalty for Delaying Product Launch

The trade-offs illustrated in Exhibit 7 apply only when the data in Exhibit 3 appropriately describe penalties for delays ranging from one to six months. It is, however, not only possible but likely that a company's penalty for being late to market will differ from these data. Consider the case of a truly innovative product, one that has no real competition, where a delay of a month or two may have little impact. But in a highly competitive market, where numerous competitors frequently introduce new products, a delay of even a few months might cause the firm to completely miss a market opportunity.

To examine the effect of different delay penalties, assume that the penalties for delay in Exhibit 3 *are too extreme* for a particular product. To assess the

Exhibit 7. Cost/Trade Trade-offs at Varied Gross Margins



implications of less extreme penalties, we reduced the penalties in Exhibit 3 by half, as shown in Table C.

Table C
Reduced Delay Penalties

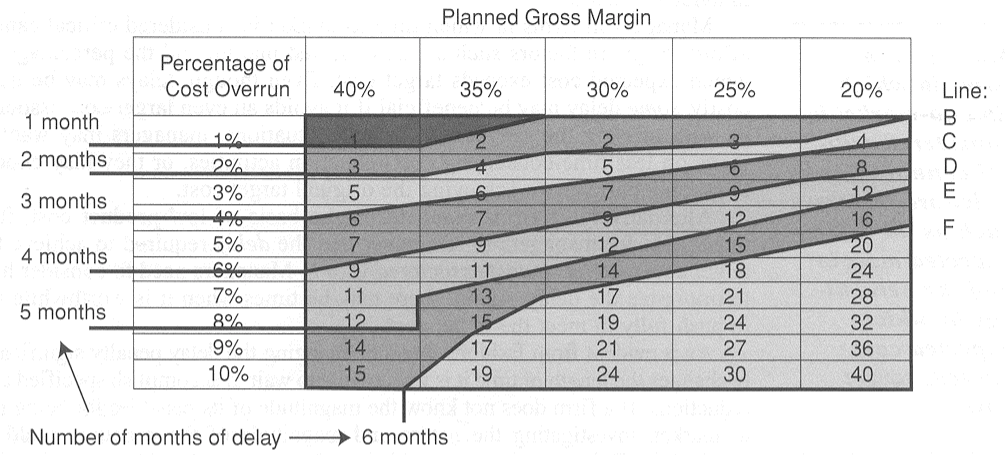
If the length of delay in months is:	1	2	3	4	5	6
Gross margin % will be reduced by:	1.5%	3.5%	6%	9%	12.5%	16.5%

The reduced delay penalties in Table C change the cost/time trade-off, as illustrated in Exhibit 8. Note how the indifference lines have shifted up and to the left. With lower penalties for delay, it is now worthwhile to invest more time to redesign products than previously. For example, if the product cost overrun is 10 percent and the expected gross margin is 35 percent, with the lower cost penalties for delay, the company is now willing to invest six months to achieve the target cost (Exhibit 8), whereas previously it would have been willing to invest only four months to achieve the target cost (Exhibit 7). Similar indifference curves can be drawn for whatever cost of delay penalties a company determines it will face.

Summary of the Cost/Time Trade-off Framework

The cost/time trade-off framework considers the magnitude of the product cost overrun, the magnitude of the expected gross margin, the time

Exhibit 8. Cost/Time Trade-offs for Reduced Delay Penalties



required to redesign the product to achieve the target cost, and the amount the company is penalized if the product is late to market.

This framework supports earlier findings that even those firms that consider cost a high strategic priority sometimes proceed without redesign to achieve the target cost, and even those firms that consider cost a lower strategic priority sometimes delay to redesign to achieve the target cost. The framework goes further in that it illustrates conditions under which it is beneficial financially redesign a product to achieve the target cost and conditions under which it is beneficial financially to proceed without redesign. We also illustrate that the trade-off is, not surprisingly, sensitive to the amount the company is penalized for being late to market.

The framework goes further in that it illustrates conditions under which it is beneficial financially redesign a product to achieve the target cost and conditions under which it is beneficial financially to proceed without redesign.

CONCLUSION

This article presents a framework that enables an NPD team to trade off the financial implications of the time required to redesign a product to achieve the target product cost versus the financial ramifications of proceeding with the market launch without redesigning a product that exceeds its target cost. The framework includes four basic factors:

1. The product cost overrun percentage,
2. The magnitude of the firm's expected gross margin,
3. The time in months required to redesign the product to achieve the target product cost, and
4. The amount the firm is penalized for a given delay if the product is late to market.

The framework is flexible, allowing managers to change assumptions regarding the magnitude of the four key framework components to fit their individual situations.

Managers in firms in which time-to-market is considered critical cannot afford to ignore factors such as the expected margin and the percentage by which expected cost exceeds target cost.

Managers in firms in which time-to-market is considered critical cannot afford to ignore factors such as the expected margin and the percentage by which expected cost exceeds target cost. Even though delays may be quite costly, *some* delay may be beneficial if it avoids an even larger cost associated with missing the cost target. In such situations, managers may want to focus on less time-consuming cost-reduction activities, or they may choose to go only part way to achieving the original target cost.

Alternatively, if firms compete on the basis of low product cost, it is imperative for managers to remember that the *delay* required to achieve the target cost *also has a cost associated with it*. Managers need to consider how to minimize the delay. Again, there may be times when it is worthwhile not to push fully to meet the target cost.

As is evident from Exhibits 7 and 8, changing the delay penalty significantly changes the length of time it is worthwhile to wait to accomplish specified cost reductions. If a firm does not know the magnitude of its penalties for being late to market, investigating the nature and magnitude of the penalties could be worthwhile. Delay penalties are unlikely to be the same for different industries; thus industrywide investigations might be appropriate. Consideration should also be given to whether the penalties might vary by firm or whether they might vary for different products or product categories within one firm.

When considering the trade-off between product cost and time, product development teams must be sure that they are not comparing apples and oranges.

Product development teams must examine carefully the financial implications of product cost overruns and delays in making the cost/time trade-off. To members of a team, a 1 or 2 percent product cost overrun may sound small and almost insignificant, but (especially when combined with a narrow planned gross margin) it can have a significant and long-lasting effect on the profitability of the product. Further, when considering the trade-off between product cost and time, product development teams must be sure that they are not comparing apples and oranges. Using the delay penalties in Exhibit 4 to illustrate, an 18 percent penalty for a four-month delay sounds large compared to a 5 percent product cost overrun. But if the planned gross margin is 20 percent or less, the 5 percent product cost overrun results in a larger penalty. Thus, product development teams and their management need to examine the effect of both product cost overruns and delay on gross margins. ◆

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