

# Escalation of Commitment During New Product Development

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*Although periodic review is a prominent feature of new product development (NPD) processes, important questions about how managers make critical continuation/termination decisions in risky NPD projects remain unanswered. The authors test whether factors unrelated to a new product's forecasted performance cause managers to continue NPD projects into subsequent stages of development at rapidly accelerating costs. The results show that managers who initiate a project are less likely to perceive it is failing, are more committed to it, and are more likely to continue funding it than managers who assume leadership after a project is started. There is also the tendency toward increased commitment for more innovative products compared with less innovative ones. The results suggest that simply giving managers better information will not necessarily lead to better decisions. Finally, the results show that escalation of commitment is a more serious problem during NPD than after the product is commercialized.*

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If at first you don't succeed, try, try again. Then quit.  
No use being a damn fool about it.

—W. C. Fields

In market economies, new product development (NPD) is a vital business activity. On average, nearly one-half of firms' annual sales and profits come from products commercialized within the last 5 years (Page 1993).<sup>1</sup> Sometimes companies even bet their survival on key new

products. While essential, NPD involves great risks since new product failure is common and expensive. Research has found that new products fail about 40 percent of the time (cf. Edgett, Shipley, and Forbes 1992; Page 1993). Why do so many new products fail? During the past three decades, researchers have sought to answer this question by examining various relationships between NPD activities and performance (for reviews, see Brown and Eisenhardt 1995; Henard and Szymanski 2001).

In this article, we propose that dubious projects that should have been abandoned during development sometimes proceed through commercialization only to fail in the market at substantially higher costs than if they had been terminated earlier. The consequences can be disastrous when development and launch cost hundreds of millions of dollars. Furthermore, successful new products must recoup their own development, production, and marketing costs, while also covering the cost of failures. According to Wind, "If companies can improve their effectiveness at launching new products, they could double their bottom line. It's one of the few areas left with the greatest potential for improvement" (in Power, Kerwin, Grover, Alexander, and Hoff 1993:77).

Since little is known about how managers make strategically important NPD project continuation/termination decisions, we empirically test whether and why managers are reluctant to terminate failing NPD projects in certain situations. Economic factors generally provide the impetus for developing a product, but other factors may emerge that make it difficult to terminate the project. Conventional wisdom suggests that decision makers should ignore sunk costs in financial calculations and decisions since they are irrecoverable. However, escalation of commitment theory suggests that these costs may not be sunk psychologically

and can still enter into decision making (Fox and Staw 1979; Staw 1976; Staw and Ross 1987). Staw and Ross (1981) claimed that "individuals may have a tendency to become locked into a course of action, throwing good money after bad or committing new resources to a losing course of action" (p. 578).

This article is organized as follows. In the next section, we review the relevant literature streams and develop research hypotheses. We then detail the research method used to test the hypotheses including the experimental design, manipulations, measures, and sample. Next, the results are presented. We close by discussing the findings, noting contributions to marketing theory and practice, and suggesting future research opportunities.

## THEORETICAL DEVELOPMENT

### The New Product Development Process

*Stages* and *gates* are two features of virtually all NPD processes used in companies today (Cooper 1994; Griffin, 1997). The *stages* are composed of various marketing, technical, and business or financial analysis activities necessary to generate information, solve problems, and transform ideas into product offerings. Ideally, representatives from various functional areas conduct their respective activities concurrently in each stage. The *gates* are project review points where continuation or termination decisions are made, prioritizing NPD projects take place, and critical resource commitments are made. Typically, certain individuals perform the NPD activities, while a different person or group reviews the project information and determines whether to continue investing in the project (if it appears headed for success) or terminate it before commercialization (if it appears headed for failure).<sup>2</sup>

The gates are focal points of this research and are crucial for maintaining a reasonable level of risk during an NPD project. Because costs accelerate rapidly as NPD progresses, Urban and Hauser (1993) claimed that "it is important to eliminate failures early before they lead to a major loss in investment" (p. 61). Research indicates that managers strive to control risk during NPD since many ideas are generated, few are developed, and fewer still reach the market (Booz, Allen and Hamilton 1982; Page 1993). Indeed, managers do make the tough decisions and terminate the majority of new product ideas. Nevertheless, the persistently high failure rate of new products (Booz, Allen and Hamilton 1982; Page 1993; Wind and Mahajan 1988), despite improved forecasting tools, may suggest that too few projects are canceled once started.

Although gates are a prominent feature of NPD processes, they have received little research attention. This is especially true for gates after the initial screen. Further-

more, past studies generally center on NPD activities rather than on review decisions. We have limited knowledge of how managers use information, evaluate projects, and make critical termination decisions since researchers typically examine projects that made it to market.

Two studies that focus on NPD continuation decisions provide valuable insights. Balachandra (1984) asked respondents about selected NPD projects at two decision points in the NPD process: the initial "go" decision and a later "go/stop" choice. Not surprisingly, commitment to a project by employees and management was determined to be an important factor in its continuation. Balachandra did not examine commitment to potentially failing projects, which is detrimental to effective NPD. In the second study, Cooper and Kleinschmidt (1990) investigated NPD projects that were terminated before commercialization by looking at both process characteristics (e.g., quality of execution of NPD activities and resources spent) and project characteristics (i.e., market attractiveness, competitive situation, synergy, and project advantage) to determine whether these differed across successful, failed, and terminated projects. The study provides insight into how successes are perceived to differ from failures and terminated projects but did not probe the decision process and pinpoint influences on the continuation or termination choice.

Scholars suggest that managerial commitment to failing NPD projects is a serious problem. For example, Balachandra (1984) contended that "individuals get emotionally involved in the [NPD] project and are very reluctant to terminate it, even if there are many clear signals that the project is not going to be successful" (p. 92). However, no empirical support is offered. Cooper, Edgett, and Kleinschmidt (1998) stated,

In one leading firm, an internal audit of 60 current projects revealed that 88% resembled an express train slowing down at the stations [project reviews] but never with the intention of being stopped! Only 12% were handled in a thoughtful way with rigorous Go/Kill decision points. Even when killed, some projects have a habit of being resurrected, perhaps under a new name. (P. 18)

### Escalation of Commitment Theory

Following Staw and Ross (1987); Barton, Duchon, and Dunegan (1989); and Staw (1997), we define escalation of commitment as the *continuation* in a failing course of action.<sup>3</sup> Escalation situations invariably involve the opportunity to either persist with or withdraw from the course of action, and subsequent investment may reverse or compound earlier losses. Although the final outcome (i.e., success or failure) is unknown in advance, the decision maker continues to invest in the failing course of action (Staw and Ross 1987). In other words, he or she persists despite

information that indicates the outcome is unlikely to be successful.

On the basis of our reviews of the NPD and escalation of commitment literatures, we believe we can advance knowledge in two ways. First, drawing from escalation of commitment research, we primarily strive to show that managers can become committed to failing NPD projects and offer some reasons why such suboptimal decision making occurs. Although escalation of commitment theory has not been used much in the field of marketing, it is well suited to study the NPD process as illustrated by Boulding, Morgan, and Staelin (1997), who studied managers' decisions to either keep a failing product on the market 2 years after it was launched or withdraw it from the market. The focus was on decision aids (i.e., "stopping rules") that reduced commitment after commercialization. Second, we believe we can advance our understanding of escalation of commitment theory itself. The mechanism of escalation of commitment remains relatively unknown and underresearched. A better understanding of this phenomenon may open future paths for research into minimizing its occurrence.

To advance knowledge, we selected three dependent variables for this study. Each of them is described next along with the rationale for including them in this study.

1. *Perceptions of the likelihood of failure during a hypothetical failing NPD project.* During NPD projects, managers receive information to help them make decisions. To make a seemingly irrational NPD decision (allowing a failing project to continue), they must either ignore or bias the negative performance feedback information. Boulding et al. (1997) found that managers who opted to keep a failing product on the market misinterpreted information. We posit that in certain circumstances, information-processing errors cause managers to overestimate the chances of success. In essence, their risk tolerance is greater compared with that of managers who interpret the negative information more accurately, thereby allowing managers to become more committed to a failing NPD project and more likely to continue it onto higher levels of investment (cf. Forlani, Mullins, and Walker 1996).

2. *Commitment to an NPD project.* While researchers frequently study escalation of commitment from a behavioral perspective by focusing on decisions, following Kiesler (1971), we believe that there is a psychological perspective as well.

3. *Managers' NPD project continuation or termination decisions.* Ultimately, the concern is on the managers' decisions to either persist in the losing venture or withdraw from it. Although the first two dependent variables do not stem directly from previous escalation of commitment research, they have the potential to advance understanding of NPD decision making as well as escalation of commitment theory. The continuation or termination decision is the variable of interest in most escalation of commitment

research and may advance understanding of NPD decisions.

## Independent Variables

Staw and Ross (1987) discussed four categories of determinants of escalation of commitment. *Project determinants* are the rational or economic components of the project including market share, estimated sales volumes and profits, and financial performance measures (e.g., internal rate of return and return on investment). *Psychological determinants* induce errors in decision making or commit individuals to courses of action due to self-justification and information-processing biasing and limitations. *Social determinants* can cause one to stay a course of action due to social pressures such as norms for consistency, face-saving (i.e., external justification), and public identification with a project. Finally, *structural determinants* center on characteristics of the organization and the organization's culture that can make it difficult to change a course of action. Structural determinants may include capital acquisition and its salvage value; compensation or reward systems; institutionalization of values, missions, and goals; and technical and economic side bets.

Drawing from the literature in the areas of escalation of commitment and NPD, we selected three independent variables as the foci of this study:

1. Personal responsibility for initiating an NPD project that showed signs of failing.<sup>4</sup>
2. The innovativeness of the new product.
3. The credibility of the source providing feedback during the project.

Personal responsibility, a psychological determinant, was chosen for this study since it is arguably the key driver of escalation behavior. Product innovativeness, a project determinant, was included because past research findings and anecdotal examples suggest that managers might become overly excited about innovative new products. Finally, information source credibility, which we classify as a psychological determinant, was selected to advance our understanding of the mechanism of escalation of commitment. Each of the independent variables is discussed next.

### Personal Responsibility

In the seminal escalation of commitment study, Staw (1976) found that respondents allocated the most money in a subsequent decision when they were personally responsible for initiating a course of action and when the outcome was negative. Subsequent research has supported this finding in a variety of decision-making experiments (e.g., Bazerman, Giuliano, and Appelman 1984; Boulding et al. 1997; Simonson and Staw 1992; Whyte 1991).

The mechanism most closely associated with escalation of commitment is self-justification (Brockner 1992; Staw and Ross 1987). According to the theory of cognitive dissonance (Festinger 1957), people try to reduce sources of cognitive inconsistency (e.g., incongruity between their perceptions or desires and reality). They seek to justify both to themselves and others the rationality and "correctness" of their past decisions. Whereas the investment of more resources may improve a situation and therefore validate earlier decisions (Staw 1976), abandoning a course of action, even though ineffective, equates to admitting failure. This may greatly discomfort individuals psychologically (Brockner et al. 1986).

*Hypothesis 1:* Compared with managers not personally responsible for initiating an NPD project, managers who are personally responsible for initiating a NPD project will (a) rate a failing NPD project as less likely to fail, (b) report a higher level of commitment to a failing NPD project, and (c) be more likely to continue funding a failing NPD project.

#### **Product Innovativeness**

Not all new products are new.<sup>5</sup> At one extreme are radical innovations, while at the other are incremental improvements. The former (exemplified by cellular telephones, nylon, and magnetic resonance imaging systems in medicine) can offer new, unique, or superior solutions to users' needs and can create entirely new markets. Such innovations may stem from technological discontinuities that create a new generation of products that perform much better than the old. Incremental improvements include line extensions, cost reductions, and "me-too" products. These may or may not be new to the firm, but they definitely are not new to the market since the marketing and manufacturing methods for such products are well-known.

It could be argued that radical innovations are more likely to fail than incremental ones. New products can fail for technical reasons (e.g., product performance, durability, quality) and marketing reasons (e.g., incorrect positioning, lack of product awareness, pricing errors). Compared with incremental new products, more innovative ones are more likely to fail due to both technical and marketing reasons. On the technical side, the product may not work as intended or as consumers expected, for example. With respect to marketing, the product might not deliver benefits that consumers appreciate and are willing to pay for.

In contrast, we take the opposite side of the argument and propose that managers will believe that more innovative products are less likely to fail than incremental ones (Schmidt and Calantone 1998). In an influential article, Calantone and Cooper (1979) found the number one reason for industrial new product failure to be "the better mousetrap that no one wanted" (p. 173) and noted the absence of technical problems and market forces for such

products. This research suggests that managers get excited about having a product that is different (better) than other products in the market. More important, compared with an incremental innovation, a radical innovation may turn out to be an extremely profitable winner and may even realign competitive priorities in the industry or product category. A radical innovation frequently offers greater variability in sales and profits than an incrementally innovative product. Accurately forecasting the diffusion rate of radical innovations is more difficult than forecasting the sales of incremental ones (Urban, Weinberg, and Hauser 1996). Furthermore, radical innovations may provide the opportunity to define the market or technological standards, create barriers to entry, and provide above-normal economic returns. Not surprisingly, research repeatedly shows that product superiority is critical to achieving new product success (Calantone and Cooper 1981; Calantone, Schmidt, and Song 1996; Cooper and Kleinschmidt 1987). Cooper (1993) noted, "Superior products that deliver real and unique advantages to users tend to be far more successful than 'me-too' products with few positive elements of differentiation" (p. 58). The notion that uniqueness and superiority are keys to new product success is widely accepted.

This discussion leads us to posit that managers will be more committed to highly innovative products compared with less innovative ones all else being equal. Managers might become enamored with innovative new products, leading them to focus more on the upside potential.

*Hypothesis 2:* Compared with managers who perceive a new product as less innovative, managers who perceive a new product as more innovative will (a) rate a failing NPD project as less likely to fail, (b) report a higher level of commitment to a failing NPD project, and (c) be more likely to continue funding a failing NPD project.

#### **Information Source Credibility**

When managers allow a failing NPD project to continue despite negative feedback, they must either ignore or bias the negative information. However, we posit that negative information from credible sources is difficult to bias. There is a tendency to bias information to fit previously held beliefs and preferences (Gilovich 1983; Lord and Lepper 1979), but if the source providing information is credible, people are more likely to believe it (Hewgill and Miller 1965; Miller and Hewgill 1966). Moorman, Deshpande, and Zaltman (1993) showed that managers place more trust in marketing researchers with higher levels of marketing research expertise, and greater trust leads to greater use of marketing research (Moorman, Zaltman, and Deshpande 1992). Furthermore, the use of information during NPD is critical for new product success (from both the financial and customer standpoint) (Ottum and Moore 1997).

Studies show that situational factors affect managers' use of marketing research. For example, research findings that are perceived to be politically acceptable are used more than those that go against the political wave, and highly surprising results are less likely to be used (Deshpande and Zaltman 1982, 1984). Finally, Ottum and Moore (1997) posited that the reason marketing information gets overridden is because "decision-makers don't find it credible" (p. 271). All else being equal, negative information from a source that is not credible is more likely to be ignored or biased than when received from a credible source.

*Hypothesis 3:* When the information source is perceived to be more credible, managers will (a) rate a failing NPD project as more likely to fail, (b) report a lower level of commitment to a failing NPD project, and (c) be less likely to continue funding a failing NPD project.

### Commitment During the NPD Process

Few studies have examined escalation of commitment across multiple decision periods. One exception is Staw and Fox (1977), who found that the dollar amount invested in research and development significantly decreases in the second period and then significantly increases in the third period, which results in a U-shaped curve under conditions of high personal responsibility. Although Garland (1990) found that the willingness to allocate money to a dubious project increases positively and linearly as it moves closer to completion, the only information presented to respondents at each stage was the amount of money already spent and the percentage of the project completed. Both the lack of performance feedback and clear focus on the percentage the project was completed could engender the "logical" decision to continue the project. Finally, Garland, Sandefur, and Rogers (1990) found the likelihood of authorizing funds to drill the next oil well decreases linearly as more nonproducing wells are drilled. In their study, performance feedback is increasingly negative, and there is a definitive end to the project (i.e., a maximum number of oil wells that can be drilled), but only project-related factors were considered. They did not investigate psychological, social, and structural factors that may induce escalation of commitment. "The fact that our scenarios excluded the type of . . . *social pressures* [italics added] usually present in oil-exploration ventures may have contributed to the overall level of rationality observed" (Garland et al. 1990:726).

The work of Simonson and Staw (1992:420) leads us to believe that continued investment in a losing NPD project is more problematic during the NPD process than after commercialization. They stated that there is "little doubt that people will withdraw from an investment situation

when the economic facts become sufficiently negative and clear cut" but offer no empirical support.

In the present study, we examine how commitment changes during the stages of the NPD process. It is noteworthy that the information becomes more accurate as the product moves closer to commercialization because the market and technical uncertainties are generally reduced as the project moves forward (Cooper 1993). Obviously, prior to launch, managers must make continuation decisions using projected performance information (e.g., marketing research, product testing); actual data (e.g., sales and profits) are available only after the product is commercialized. It should be easier for managers to ignore or bias forecasts rather than actual performance data. In addition, confronted with increasingly negative performance information and rapidly accelerating costs, the effects of the independent variables should diminish during the stages of the NPD process.

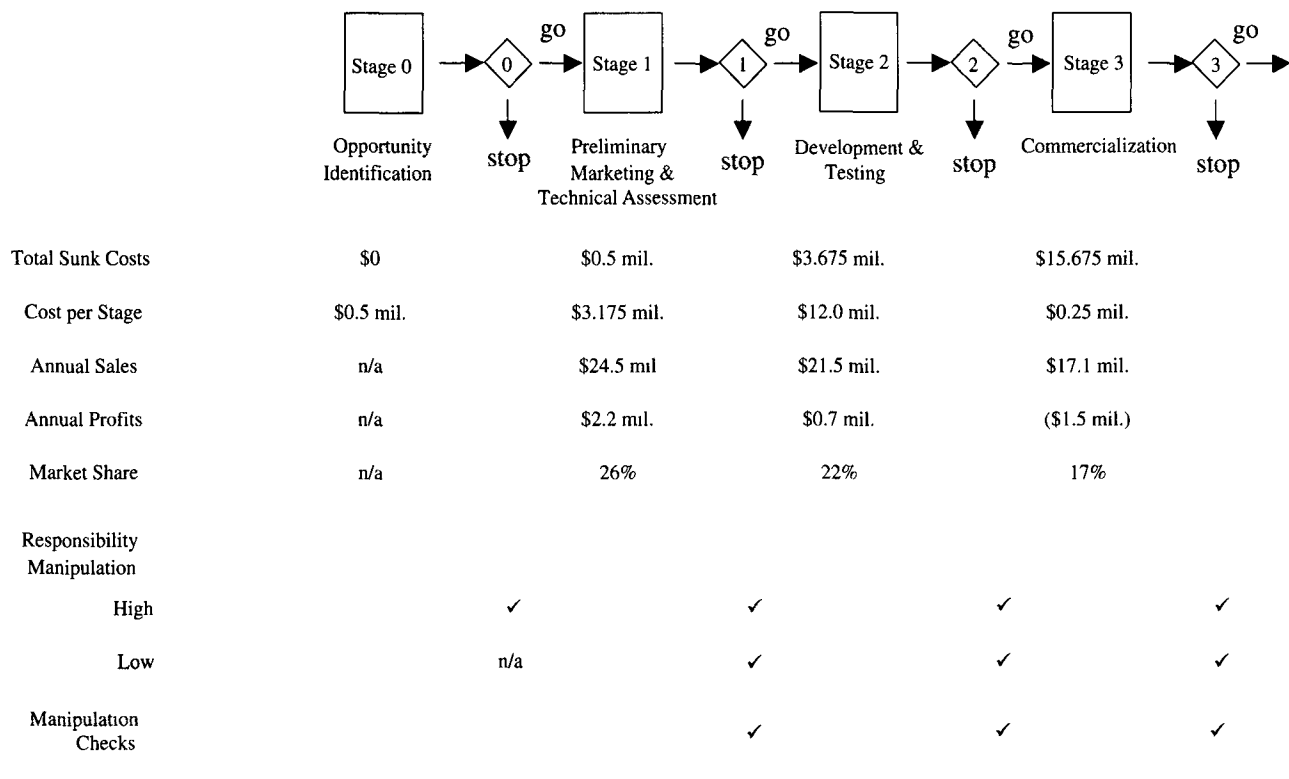
*Hypothesis 4:* The effects of personal responsibility, product innovativeness, and information source credibility on managers' ratings of the likelihood of success, levels of commitment, and project funding decisions will be weaker after the product is commercialized than before it is commercialized.

### RESEARCH DESIGN AND METHOD

To test the research hypotheses, we conducted a  $2 \times 2 \times 2 \times 3$  decision-making experiment. Personal responsibility (PR) for initiating a subsequently failing NPD project, product innovativeness (PI), and information source credibility (ISC) were each manipulated to be either high or low, thus forming an eight-cell, between-subjects design. In addition, a repeated measures (within-subjects) design required each participant to evaluate information and make decisions at three points in a hypothetical NPD project. The information provided to assist in making the decisions was the same for all participants.

Following Boulding et al. (1997), we used an experimental design to test the research hypotheses, and we did so for three important reasons. First, most threats to internal validity can be reduced through controlled experiments, and internal validity and control are essential to establishing true causation (Cook and Campbell 1979). Second, accurate testing of the research hypotheses would be virtually impossible using any other method. For example, descriptive research techniques such as surveys or personal interviews that center on actual decisions in past NPD projects might not yield truthful answers about suboptimal decisions. More important, managers probably do not really know why they made certain decisions in the past. Third, experiments are commonly used to study escalation of commitment. Typically, researchers ask

**FIGURE 1**  
**An Overview of the Decision-Making Experiment**



participants to play the role of decision maker in a series of related investment choices, based on their examination of feedback information. This method is ideal for studying the NPD process since it closely parallels the actual tasks undertaken by those who review NPD projects.

The experiment was designed after conducting in-depth case study interviews that centered on eight NPD projects in three companies. The interviews followed the procedures outlined by Yin (1994). For each project, we interviewed multiple NPD team members.<sup>6</sup> The sessions were recorded on audiotape and transcribed for interpretation. The case studies helped us develop the experimental treatments, procedures, and performance feedback information, all of which were finalized after conducting a pilot study.

The experimental participants were managers drawn from executive programs who were randomly assigned to one of the eight conditions. The authors traveled to several executive education sites across several months to administer the experiment in small groups.<sup>7</sup> Participants were asked to act as NPD managers in Exxel Electronics, a fictitious corporation; they reviewed project information, made funding decisions, and answered related questions. The instructions and all information were printed in booklets. The participants were allowed to ask questions during the experiment by speaking privately to the researchers as

others continued to work. There was no interaction among them until the end of the experiment, during the debriefing. An overview of the experiment is depicted in Figure 1.

At the outset, all participants were instructed that Exxel's top management mandated that new products must achieve at least 30 percent market share and must be profitable. At the completion of each stage, all participants received feedback on market share, sales, and profits to assess the performance of the new product. This information was forecasted before product launch (Stages 1 and 2) and actual after commercialization (Stage 3). Again, it is important to note that the feedback given to all participants in all conditions was *identical*.

As shown in Figure 1, performance information grew progressively ominous during the course of the project (i.e., increasingly likely to fall short of the hurdle rates set by management). Qualitative information (performance and otherwise) also was provided but was unrelated to the hurdles. This included the costs incurred in the project to date (sunk costs) and the approximate cost to complete the next stage. Care was taken to "frame" (Kahneman and Tversky 1979) feedback in the experiment in a neutral fashion and let the participants decide for themselves about project performance; research has shown that framing the feedback negatively can increase escalation (Davis and Bobko 1986). Specifically, performance data were

simply presented, not interpreted, and no reference was made to the performance relative to management's hurdles. At each stage, participants indicated their likelihood of funding the next phase and answered questions about their level of commitment to the project, assessed the likelihood of the product failing in the market, and answered manipulation check questions.

### Measures of Dependent Variables

While most escalation of commitment studies use a single behavioral dependent variable, we used three constructs to potentially advance our understanding of the escalation of commitment phenomenon and NPD decision making. The measures appear in Appendix A. The first construct is the perceived likelihood of new product failure (FAILURE). Most researchers typically have not distinguished between behavior and cognition and have measured commitment from a behavioral perspective only. Following Binder (1985), we measured it from both behavioral and psychological perspectives. The second construct is the level of self-reported commitment to a failing NPD project (SRCOMT). The third construct, the likelihood of funding the next stage of the process (FUND), measures behavioral commitment and is similar to that used by other researchers.

### Manipulations of Independent Variables

The manipulations for the independent variables are explained in more detail in Appendixes B and C. Each is discussed briefly below.

#### Personal Responsibility (PR)

We chose to manipulate PR in a manner similar to Staw (1976) and most other escalation of commitment studies. At Stage 0 in Figure 1, individuals in the high-PR condition were responsible for choosing one of two new product ideas to develop (an air bag sensor or a brake sensor). The participants were informed that resource constraints precluded development of both. Little information was available to assist them in their choice, and the information available was unrelated to the performance hurdles set by management. They justified their choices in written, open-ended responses that were given to the authors administering the experiment.<sup>8</sup> Then, participants in the high-PR condition received Part 2 of the experiment with either a blue or green cover depending on which product was chosen to develop, although the information contained therein did not differ. Participants in the low-PR condition assumed leadership of the air bag sensor NPD project (at Stage 1 in Figure 1) that their predecessor initiated before being

transferred to Europe. They were not responsible for initiating it.<sup>9</sup>

#### Product Innovativeness (PI)

When developing the manipulations for the PI conditions, two pairs of hypothetical products were used from the automobile electronics industry in an attempt to minimize the confounding effect of different product categories. We deliberately chose products about which most people have little prior knowledge. The highly innovative new products offered substantial performance or cost advantages over existing products. The less innovative new products were line extensions that offered very marginal performance and cost reductions.

#### Information Source Credibility (ISC)

Like the other factors, ISC was manipulated to be either high or low. In the high condition, information sources were credible because they held positions in well-respected research firms and had proven reliable and accurate in past NPD projects. In the low condition, the information sources were not credible because they lacked skills and had been inaccurate in past NPD projects.

#### Stage of the NPD Process

The within-subjects condition required all participants to repeat the decision-making experiment at three stages of an NPD project (see Figure 1). As previously noted, participants in the high-PR condition made an additional decision (at Stage 0) by choosing one of two products to develop, although this decision was not included in the data analyses.

### Sample Size and Characteristics

We obtained 285 usable responses. In the high-PR condition, 43 percent chose to develop the air bag sensor and 57 percent chose the antilock brake sensor.<sup>10</sup> About 35 individuals were in each of the eight experimental conditions. The sample was approximately 60 percent male. On average, participants had 7.2 years of professional work experience; the minimum was 2.0 years. The mean number of years of NPD experience was 1.6, and the largest financial decision made while acting as the sole decision maker averaged more than \$1.5 million. These figures indicate that the participants had significant decision-making experience.

As an incentive, participants were instructed that the person who made the optimum decisions in the experiment would receive a cash prize of \$200. Since a number of them qualified (decided not to fund all three stages of the NPD process), the winner was chosen at random.<sup>11</sup>

**TABLE 1**  
**Between-Subjects Effects: Perceived Likelihood of Failure**

Source	Hypothesis (H)	Type III Sum of Squares	df	M <sup>2</sup>	F	$\eta^2$	Observed Power	Significance Level	Research Support for Hypotheses
Personal responsibility (PR)	H1a	391.214	1	391.214	5.060	.018	.611	.025	Supported
Product innovativeness (PI)	H2a	597.848	1	597.848	7.732	.027	.791	.006	Supported
Information source credibility (ISC)	H3a	34.814	1	34.814	0.450	.002	.103	.503	Not supported
PR $\times$ PI		156.932	1	156.932	2.030	.007	.295	.155	
PR $\times$ ISC		8.056	1	8.056	0.104	.000	.062	.747	
PI $\times$ ISC		104.333	1	104.333	1.349	.005	.212	.246	
PR $\times$ PI $\times$ ISC		13.092	1	13.092	0.169	.001	.069	.681	
Intercept		226,693.795	1	226,693.795	2,931.888	.915	1.000	.000	
Error		21,185.701	274	77.320					

**TABLE 2**  
**Between Subjects Effects: Self-Reported Commitment**

Source	Hypothesis (H)	Type III Sum of Squares	df	M <sup>2</sup>	F	$\eta^2$	Observed Power	Significance Level	Research Support for Hypotheses
Personal responsibility (PR)	H1b	674.480	1	674.480	8.155	.029	.812	.005	Supported
Product innovativeness (PI)	H2b	635.433	1	635.433	7.683	.027	.789	.006	Supported
Information source credibility (ISC)	H3b	20.567	1	20.567	0.249	.001	.079	.618	Not supported
PR $\times$ PI		29.828	1	29.828	0.361	.001	.092	.549	
PR $\times$ ISC		56.092	1	56.092	0.678	.002	.130	.411	
PI $\times$ ISC		303.384	1	303.384	3.668	.013	.480	.057	
PR $\times$ PI $\times$ ISC		23.763	1	23.763	0.287	.001	.083	.592	
Intercept		133,784.013	1	133,784.013	1,617.478	.854	1.000	.000	
Error		22,828.372	276	82.711					

Managers spent approximately 30 minutes completing the experiment. We observed numerous people evaluating numerical information with financial calculators. Many of the completed booklets had calculations in the margins or in the open-ended questions to justify their decisions. These facts suggest that the managers were involved in the exercise.

Based on manipulation check results, the experimental treatments were effective and remained strong during the stages of the experiment (i.e., the means for the high-PR, high-PI, and high-ISC conditions were significantly higher than in the low conditions,  $p \leq .001$ ). The effectiveness of each manipulation was assessed using questions measured on 7-point scales (anchored by *strongly agree* and *strongly disagree*). For the PR manipulation, the items were the following: "The initial decision to develop this new product was mine" and "My predecessor initiated this new product project before I took it over" (reverse scaled). For the PI manipulation, the items read, "This new product is revolutionary" and "This new product offers minimal advantages over existing products" (reverse scaled). For the ISC manipulation, the item read, "The source(s) that provides feedback information during Exxel's new product projects is (are) not credible" (reverse scaled).

## ANALYSIS AND RESULTS

### Between Subjects

We analyzed the data using use repeated measures analysis of variance (ANOVA). A separate repeated measures ANOVA was computed for each dependent variable (FAILURE, SRCOMT, and FUND) using the stage in the NPD process as the within-subjects factor. The results for each appear in Tables 1, 2, and 3, respectively. We report the means for the between-subjects tests in Table 4.<sup>12</sup>

Tables 1 and 4 show that across the three stages of the NPD process, managers in the high-PR and high-PI conditions were significantly less likely to perceive that the new product would fail compared to the low-PR and low-PI conditions ( $p = .025$  and  $.006$ , respectively). These findings support Hypotheses 1a and 2a. Contrary to Hypothesis 3a, the main effect of ISC exerted no significant influence on perceptions of the likelihood of failure ( $p > .05$ ).

Similar results were found for self-reported commitment to the failing NPD project. Table 2 and Table 4 show that managers personally responsible for initiating the project reported a higher level of commitment to it, which supports Hypothesis 1b ( $p = .005$ ). Managers also were



**TABLE 3**  
**Between Subjects Effects: Likelihood of Funding**

Source	Hypothesis (H)	Type III Sum of Squares	df	M <sup>2</sup>	F	$\eta^2$	Observed Power	Significance Level	Research Support for Hypotheses
Personal responsibility (PR)	H1c	92.689	1	92.689	4.732	.017	.582	.030	Supported
Product innovativeness (PI)	H2c	45.946	1	45.946	2.346	.008	.332	.127	Not supported
Information source credibility (ISC)	H3c	0.724	1	0.724	0.037	.000	.054	.848	Not supported
PR $\times$ PI		28.958	1	28.958	1.478	.005	.228	.225	
PR $\times$ ISC		0.097	1	0.097	0.005	.000	.051	.944	
PI $\times$ ISC		14.945	1	14.945	0.763	.003	.140	.383	
PR $\times$ PI $\times$ ISC		20.347	1	20.347	1.039	.004	.174	.309	
Intercept		15,492.408	1	15,492.408	790.934	.741	1.000	.000	
Error		5406.145	276	19.587					

**TABLE 4**  
**Simple Means for Main Effects**

Dependent Variable	Main Effect	Condition	Stage		
			1	2	3
Perceived likelihood of failure	Personal responsibility	High	2.8	4.3	4.7
		Low	3.4	4.6	4.8
	Product innovativeness	High	3.0	4.2	4.6
		Low	3.2	4.8	4.9
Self-reported commitment	Information source credibility	High	3.1	4.4	4.7
		Low	3.1	4.5	4.8
	Personal responsibility	High	3.9	3.2	3.0
		Low	3.3	2.7	2.8
Likelihood of funding	Product innovativeness	High	3.8	3.2	3.0
		Low	3.5	2.6	2.7
	Information source credibility	High	3.7	3.0	2.9
		Low	3.6	2.9	2.8
	Personal responsibility	High	6.7	3.7	3.4
		Low	5.5	3.0	3.3
	Product innovativeness	High	6.3	3.8	3.5
		Low	5.9	2.9	3.3
	Information source credibility	High	5.9	3.4	3.4
		Low	6.2	3.3	3.4

more committed to the more innovative products (Hypothesis 2b,  $p = .006$ ). Contrary to Hypothesis 3b, source credibility had no significant effect on self-reported commitment ( $p > .05$ ).

Table 3 presents results for likelihood of funding. Participants in the high-PR condition were significantly more willing to allocate funds to the failing project across the three stages as compared to the low condition ( $p = .030$ ), as posited in Hypothesis 1c. Since product innovativeness had no significant effect ( $p > .05$ ), Hypothesis 2c was not supported. Finally, contrary to Hypothesis 3c, ISC had no significant effect on the likelihood of funding.

Hypothesis 4 predicts that the effects of PR, PI, and ISC on perceptions of the likelihood of failure, self-reported commitment, and funding decisions will be weaker after

**TABLE 5**  
**Effect Sizes and Significance: Pre- and Postcommercialization**

Dependent Variable	Effect	Effect Size	
		During Development	After Launch
Perceived likelihood of failure	Personal responsibility	.026*	.002
	Product innovativeness	.026*	.014*
	Information source credibility	.000	.003
Self-reported commitment	Personal responsibility	.043*	.006
	Product innovativeness	.031*	.011
	Information source credibility	.001	.001
Likelihood of funding	Personal responsibility	.033*	.000
	Product innovativeness	.015*	.000
	Information source credibility	.000	.000

\* Significant effect at  $p \leq .05$ .

commercialization compared to during development. To test this hypothesis, we analyzed Stages 1 and 2 (before launch) together (using repeated measures ANOVA) and Stage 3 (after launch) separately (using ANOVA). The results appear in Table 5. Comparing these two phases of development stages shows that before launch, PR and PI exerted significant main effects on the three dependent variables ( $p < .05$ ), but ISC did not. After commercialization, none of the main effects of the independent variables were significantly different from zero ( $p > .05$ ), with the exception of the effect of PI on perceived likelihood of failure ( $p = .045$ ), which had a smaller effect size post-launch. These results generally support Hypothesis 4.<sup>13</sup>

In summary, PR significantly influenced perceptions of the likelihood of failure, self-reported commitment, and funding propensity throughout the NPD process. PI had significant effects on perceptions of the likelihood of failure and self-reported commitment and on funding propensity prior to launch. Generally, the effects of PR and PI

**TABLE 6**  
**Selected Participant**  
**Justifications for Decisions**

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"The only reason I would further consider authorizing this project is the sunk costs already incurred."
"The negatives (i.e., projected profits, sales, and market share) are offset by sunken costs. Got to determine recovery plan."
"A lot of money has been invested in this project, so I would continue on."
"Once you commit yourself to a project, it is very difficult to pull the plug and stop work. It becomes even more difficult once money is invested."
"Because of the sunk costs, it would be difficult at this point to stop the project and take the product off the market."
"I would continue based on the amount of work, research, and money spent. Also, because no other company has such a product."
"Though profits might decline, the development is too far along to quit."
(Before commercialization) "I still feel the product will be a success. If I was to stop now, it would reflect negatively on my decision-making skills, just as it would if the project fails." (After commercialization) "Efforts must concentrate on cutting costs and building the product in the most efficient mode possible. The marketing department must push the advantages of this product hard to stimulate more sales. These efforts must pay off to continue. Too much has been invested to stop now."
"I've seen pet projects take on their own life, driven by a person's emotions."

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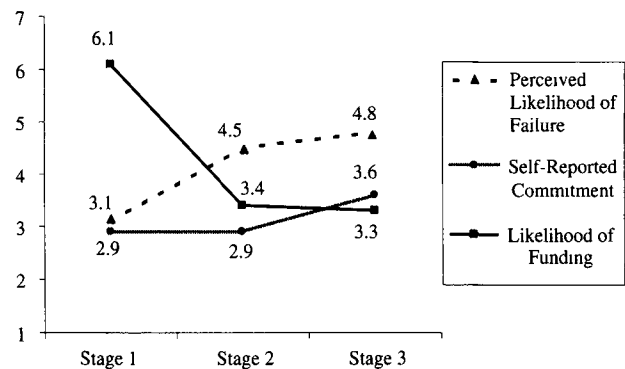
were stronger prior to launch than after the product was commercialized. Contrary to expectations, ISC did not significantly influence perceptions of product performance, commitment, or funding propensity.

In an effort to gain further insights into the reasons underlying decisions, managers were requested to justify their choices at each stage of the NPD process. Selected quotations appear in Table 6. These comments reinforce our experimental findings that managers make suboptimal decisions during NPD projects for various reasons that are unrelated to the project's expected outcome (e.g., sunk costs, emotions, commitment, ego protection, and the belief that the product is more innovative than competing products).

### Within Subjects

The within-subjects results show that perceptions of new product failure, funding propensity, and self-reported commitment changed during the NPD process. Figure 2 shows that managers increasingly perceived a poor outcome ( $p = .000$ ) and were correspondingly less likely to fund the next stage ( $p = .000$ ). Surprisingly, this figure shows that managers reported growing commitment to the failing project ( $p = .000$ ).

**FIGURE 2**  
**Changes in the Dependent Variables During**  
**the New Product Development Process**



### DISCUSSION

One objective of this article was to advance understanding of NPD review decisions. The stages have received much more attention than the gates, but the latter offer excellent opportunities for improving the effectiveness of NPD. To achieve this objective, a conceptual link was made between the NPD process and escalation of commitment. Much of the literature on NPD and new product performance research lacks a theoretical framework. In the social and organizational psychology areas, there has been substantial escalation of commitment research, but little in the marketing field with a few notable exceptions (Armstrong, Coviello, and Safranek 1993; Boulding et al. 1997; Schmidt 1996; Schmidt and Calantone 1998).

The results of this study show that escalation of commitment can occur in the NPD process. While other studies have claimed that managers tend to persist with failing NPD projects, this study offers empirical support. Furthermore, one implication is that the persistently high rate of new product failure may be due in part to the failure to abandon risky projects before commercialization. Many studies during the past three decades have sought to improve new product success rates, but this study suggests a new direction for research.

It was found that high levels of either personal responsibility or product innovativeness can cause managers to escalate their commitment to a failing NPD project. Managers who initiate a project (1) are less likely to perceive it is failing, (2) report a higher level of commitment to it, and (3) are more likely to continue funding it than are managers who assume leadership after a project has begun. While prior research established a link between PR and escalation of commitment, our study shows that this phenomenon on escalation occurs in specific reference to the

NPD process. Suboptimal decisions along the way are dangerous since the costs increase sharply as NPD progresses. If companies can improve new product success rates even marginally, they gain a competitive edge. The same holds true if firms are to abandon doomed NPD projects sooner than competitors. While much attention has been focused on cutting product development times, perhaps a fruitful avenue is researching the methods and tools for halting failing NPD projects sooner.

This study also shows a tendency toward commitment simply because the product was innovative. The more innovative products did not offer any greater financial benefit than the less innovative ones. Participants in the high-PI condition were more likely to perceive the product would succeed and more committed to it, although not more likely to fund it. Interestingly, we found that 43 percent of managers in the high-PI condition made "go" decisions at the launch stage compared with 29 percent in the low-PI condition.<sup>14</sup> Several managers in the high-PI condition reasoned that the product offered advantages over rival products and should be commercialized, even in the face of negative forecasts.

The results of this research suggest that NPD managers, employees, and perhaps even entire organizations tend to become enamored with innovations. Scientists, engineers, and marketers may spend years developing these products, and their emotional attachment may grow over time. Furthermore, they see benefits to users that potential customers do not always appreciate as much.

This study indicates that escalation of commitment is a more serious problem during the NPD process than after the product is commercialized. The effects of PR and PI on managers' perceptions of failure, self-reported commitment, and funding propensity occur almost exclusively at Stages 1 and 2. After launch (Stage 3), the effects of PR and PI generally are not significant. We reason that it is easier for managers to bias *projected* performance information than *actual* data that are available after commercialization, as Simonson and Staw (1992) claimed. Another explanation is that the managers in our experiment learned in previous stages that the new product would not be successful.

The credibility of the source providing information during a failing NPD project had no effect on any of the dependent variables. Because research has shown that information from credible sources is more likely to be believed, we hypothesized that commitment would be lower under conditions of high ISC. Yet, our participants were still able to ignore or distort the negative performance information. They had recently taken courses in accounting and finance, and they seemed to strongly focus on the financial information provided, regardless of the source. Almost none of the subjects indicated concern about the credibility of the source or the information itself.

In addition to a better understanding of NPD review decisions, a second objective of this study was to increase understanding of escalation of commitment theory. If one presumes that the credibility of the information source is related to the credibility of the information, then our results suggest that simply giving managers more credible information will not necessarily lead to better decisions. Escalation of commitment stems from both economic and noneconomic factors (Simonson and Staw 1992; Staw and Ross 1987). In the first category are market performance projections (e.g., sales, profits, market share) used to make NPD decisions, although our findings suggest that even credible data from high-priced marketing research firms and consultants may be biased because of noneconomic factors. Perhaps resources should be directed at reducing those social, psychological, and structural factors identified by Staw and Ross (1987) before investing in better information.

We provide empirical evidence of information biasing in the NPD process. The participants received identical performance feedback, but those in the high-PR and high-PI conditions were significantly more likely to persist or stay committed psychologically to the failing NPD project than those in the low-PR and low-PI conditions. This means that the negative financial information was either ignored or biased. If it was ignored, then there should be no significant difference in the perceptions of new product failure between the high and low groups. Because that was not the case, participants must have interpreted the negative information as relatively more positive. Indeed, research shows that people tend to bias information to fit their beliefs and preferences. Boulding et al. (1997) found that participants who committed to failing products interpreted negative information positively in 152 of 155 instances at the postcommercialization stage. By viewing poor-performance feedback information more favorably, individuals in the high-PR and high-PI conditions kept the project moving forward by underestimating the level of risk (i.e., odds of failure) associated with the new product.

Commitment was conceptualized and measured from both behavioral and self-reported (i.e., psychological) perspectives. Although the between-subjects results were similar across the dependent variables, interesting differences were revealed by the within-subjects analyses. In all experimental conditions, managers increasingly (and correctly) realized that the project was headed for failure and were increasingly reluctant to fund it. Yet, interestingly, their self-reported commitment grew and was highest in the postcommercialization stage when the product was most clearly a failure. Most researchers have operationalized escalation of commitment exclusively from a behavioral perspective, but this study shows that self-reported (psychological) commitment is distinctly different.

Finally, unlike most NPD research, we use an experimental design to advance knowledge. Montoya-Weiss and Calantone (1994) noted that experimental designs are used infrequently in NPD research and that this literature is "plagued with threats to internal validity" (p. 398). The retrospective methods typically used induce a halo bias that may limit our understanding of new product performance (Brown and Eisenhardt 1995). Perhaps researchers tend to concentrate on external validity, or the research questions are better addressed with other methods. Nevertheless, internal validity is essential to establish true causal relationships (Cook and Campbell 1979).

An inherent limitation of our research (and all escalation of commitment studies that use decision-making experiments) is that the stakes are low in hypothetical circumstances (Brockner et al. 1986; Garland et al. 1990; Staw and Ross 1987). Although the experimental design, manipulation checks, and a financial incentive were intended to increase participants' involvement and effort in our study, no experimental setting can simulate the anxiety, pressure, and consequences of being held responsible for a multimillion dollar new product failure.

### **Potential Ways to Reduce Escalation of Commitment During NPD**

While the purpose of this study was not to empirically test methods to reduce escalation of commitment during NPD, some suggestions can be gleaned for future research. To reduce the effect of personal responsibility, leadership can be rotated during the stages of an NPD project. Changing decision makers may be an effective way to reduce escalation of commitment (Boulding et al. 1997) since it prevents the self-justification effect closely associated with it (Bazerman et al. 1984). Decision makers can then focus on the project without needing to justify to themselves and others the correctness of their previous decisions. We found that prior to launch, those who had not initiated the project were less committed to it. Simonson and Staw (1992) found that people were more likely to change their course of action when there was less pressure for self- and external justification.

Leadership rotation should prevent the increase in self-reported commitment that our participants exhibited, but it has disadvantages. The role of the product champion is diminished. This person maintains momentum and enthusiasm in the NPD project, musters resources, and pushes past roadblocks (Markham and Griffin 1998). Also, there are risks associated with involving people who do not fully understand the project or who have no great interest in it. Furthermore, ambition and envy among managers may prompt new leaders to drop promising projects began by their predecessors.

Allowing managers to set a stopping rule before starting a project has been shown to reduce persistence in a

losing course (Boulding et al. 1997). In our research, clearly defined performance hurdles were not found to prevent escalation, perhaps because the criteria were imposed rather than selected by the decision makers. In actual NPD projects, the psychological, social, and structural forces that drive escalation may or may not be powerful enough to cause one to ignore the stopping rules. A more critical issue is the practicality of allowing NPD managers to define the performance hurdles. Typically, top management sets hurdles for important projects, and it may not be feasible or prudent to give NPD managers autonomy.

Other methods might reduce escalation of commitment. Reward structures can be modified to be more tolerant of failure. Simonson and Staw (1992) suggested that accountability for the decision process rather than the decision outcome can reduce escalation, but evaluating NPD managers in this requires more time and effort by upper management. Forecasts, decision options, and other pertinent information must be reviewed to determine whether the decision process was appropriate, which may be an ineffective use of managerial resources. Furthermore, because information usually is filtered before reaching the higher levels of an organization (Janis and Mann 1977), this technique is difficult to implement. It also usurps NPD managers' power when upper management scrutinizes their decisions. Fox and Staw (1979) also noted that whenever managers feel compelled to defend their actions against critics, they will be less flexible in their decision making.

Since it appears that product innovativeness affects assessments of failure and the level of commitment to a failing project, strategies could be developed to focus attention on the feedback information. Especially for radical innovations, a higher level of monitoring may curb escalation. It may be necessary to have more NPD review points for innovative products compared with incremental ones.

It appears that the decision-making unit can be structured to reduce escalation of commitment during NPD. Recent research suggests that teams make more effective NPD continuation or termination decisions than individuals (Schmidt, Montoya-Weiss, and Massey 2001). Cross-functional project review teams appear to reduce the likelihood of escalation for two reasons. First, teams almost always have more collective experiences and knowledge than individuals acting alone. These facts may increase the number of issues and alternatives considered when making NPD decisions and increase their decision-making effectiveness. Second, team decisions should dilute the level of responsibility each member feels. Team members should feel less personal responsibility and therefore less need to prove the prior decision correct to themselves and others.

## Directions for Future Research

A fruitful avenue would be to investigate actual NPD projects over their development cycle. We chose to focus on internal rather than external validity, but longitudinal research would further our understanding. The risks and costs associated with longitudinal research are high, but the payoffs could be significant.

Furthermore, we believe there are three other promising areas for future research. First, although two key drivers of escalation in the NPD process have been verified, others remain to be tested. Future research could focus on four categories of determinants: (1) individual decision makers (e.g., level of generalized self-confidence), (2) the firm (e.g., reward structure), (3) the project (e.g., the level of riskiness), and (4) the market in which a firm competes (intensity of industry competition). Second, more work is needed on the escalation of commitment mechanism. We need to better understand why escalation of commitment occurs during the NPD process. Finally, the de-escalation strategies suggested previously need to be empirically tested and verified in the context of NPD.

## Conclusion

This research suggests that escalation of commitment in the NPD process contributes to the rate of new product failure because of decision makers' reluctance to abandon failing projects. Since costs generally rise as NPD progresses, it is important to terminate doomed NPD projects early. Review points are designed to help managers control risk, but escalation of commitment translates into NPD projects that are more likely to be continued despite the warning signs. Firms that make better decisions and make them earlier in the NPD process can reallocate resources to more deserving projects, thereby gaining a competitive advantage.

### APPENDIX A Measurement Items and Reliabilities

	Coefficient Alpha		
	Stage 1	Stage 2	Stage 3
Likelihood of Failure <sup>a</sup> (FAILURE)	.85	.88	.84
I believe that this new product will fail to meet the hurdle rates set by management.			
I believe that this new product will be a success. (R)			
Ultimately, I believe that this new product will contribute negatively to my annual performance rating.			
The performance of this new product will help my career. (R)			

	Coefficient Alpha		
	Stage 1	Stage 2	Stage
Self-Reported Commitment <sup>a</sup> (SRCOMT)	.79	.88	.90
I am committed to this new product.			
I would feel guilty if I stopped funding this new product development project. <sup>b</sup>			
I will stick with this new product no matter what problems are encountered. <sup>b</sup>			
I feel a sense of loyalty to this new product. <sup>b</sup>			
Likelihood of Funding <sup>c</sup> (FUND)			
How likely is it that you would authorize the funds necessary to complete the next stage of this new development project? <sup>d</sup>	NA	NA	NA

NOTE: (R) indicates a reversed-scaled item; NA = not applicable. We conducted confirmatory factor (CFA) analysis using EQS software and determined that the multi-item constructs were distinctly different. For brevity, we do not report the CFA results.

a. Item measured on a 7-point scale anchored by *strongly agree* and *strongly disagree*.

b. Adapted from Binder (1985).

c. Item measured on an 11-point scale (i.e., 0% to 100% chance) anchored by *definitely would not authorize* and *definitely would authorize*, with *even chance* at 50 percent.

d. Adapted from Garland (1990).

### APPENDIX B Personal Responsibility (PR) and Product Innovativeness (PI) Manipulations

#### Low-PR Condition

You have been reassigned to the position of product development manager for Exxel's automotive group. Your predecessor came up with the idea to develop the new airbag sensor. Prior to being transferred to Exxel's European operations, your predecessor recommended to top management that this new sensor be developed. You are assuming leadership responsibility for the new product project, which is currently at Stage 2 (i.e., preliminary market and technical assessment). (Note: Under the low-PR condition, product innovativeness was manipulated using the airbag sensor only.)

#### High-PR Condition (with low-PI condition)

As a product development manager, you have the option of developing one of two potential new products. One product is an air bag sensor, and the other product is an antilock brake sensor. Both of the products are described below.

**Product 1: Air bag sensor.** The proposed new air bag sensor will offer incremental advantages over the existing one since it will be identical in form and function to Exxel's existing sensor. However, this new sensor has a marginally more efficient design. Consequently, it will be a little smaller and will cost slightly less to produce (i.e., 2%).

*Product 2: Antilock brake sensor.* The proposed new antilock brake sensor will offer incremental advantages over the existing one since it will be identical in form and function to Exxel's existing sensor. However, this new sensor is slightly more durable and will cost a little less to produce (i.e., 1.5%).

### High-PR Condition (with high-PI condition)

As a product development manager, you have the option of developing one of two potential new products. One product is an air bag sensor, and the other product is an antilock brake sensor. Both of the products are described below.

*Product 1: Air bag sensor.* The proposed new air bag sensor is highly innovative and will offer substantial advantages over the existing one. Unlike the current sensor, which is silicon based, the new sensor will incorporate a radically new diamond sensor technology that will make it resistant to all corrosive materials, elements, and weather conditions. While current sensors are reliable, the new sensor will be a vast improvement and will continue to work properly for decades. This is extremely important since an air bag sensor must work perfectly; it cannot deploy an air bag in the absence of a collision, nor can it fail to deploy in a collision. Automakers face potentially huge lawsuits if an air bag system fails. In addition, with advances in industrial diamond fabrication, the new sensor will be substantially smaller (i.e., 75%).

*Product 2: Antilock brake sensor.* The proposed new antilock brake sensor will offer substantial advantages over existing sensors due to its highly innovative design. This new sensor has a radically new architecture and will cost substantially less to produce (i.e., 85%), thereby making it economically feasible to offer high-performance antilock brakes on lower priced cars. In the past, high-performance antilock brake systems were found only on luxury cars. This is a significant advance since the average stopping distance will be shortened considerably due to these brakes, thereby reducing the number of traffic accidents and saving lives.

## APPENDIX C

### Information Source Credibility (ISC) Manipulations

#### Low-ISC Condition

Throughout the new product development (NPD) process, managers receive information to help them make financial investment decisions. In Exxel Electronics, this information is provided by Exxel's sales force personnel, most of whom have had little formal training in marketing research. In addition, Exxel's sales force has, in the past, provided information that has proven to be extremely unreliable and inaccurate in past new product projects.

#### High-ISC Condition

Throughout the NPD process, managers receive information to help them make financial investment decisions. In Exxel Electronics, this information is provided by nationally known, presti-

gious marketing research firms, advertising agencies, and consultants. In addition, these sources have, in the past, provided information that has proven to be extremely reliable and accurate in past new product projects.

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## NOTES

1. We use the term *product* to refer to individual products, product lines, and services.
2. There is little empirical research on the type of decision-making unit (e.g., individual or team) and the functional background of the gatekeepers. Our case studies indicate that in some firms, an individual makes the continuation or termination decisions and in other firms a team is responsible. In nearly all cases, however, evidence suggests that top managers are the decision makers.
3. Some researchers have defined *escalation of commitment* as increased funding over repeated decisions rather than continued funding (Hantula, Denicolis, and Goltz 1995).
4. Hereafter, a "failing" new product development (NPD) project. Technically, a product cannot fail until it is actually commercialized, but preliminary performance feedback (e.g., from product and market testing) can indicate that failure may be probable or even imminent.
5. See Booz, Allen and Hamilton (1982) for a classification of new product types.
6. We interviewed individuals with different backgrounds (e.g., finance, top management, engineering, marketing).
7. To maintain the confidentiality of the participants and their executive programs, the experiment was not conducted at the institutions with which the authors are affiliated.
8. For individuals in the high-personal responsibility (PR) condition, getting them to be responsible for beginning an NPD project and justify their choices to themselves and the researchers was paramount. Pretest results showed that about half of the participants chose the air bag sensor and half chose the antilock brake sensor.
9. We considered two other ways to manipulate PR. One was to tell participants they were responsible for previously initiating the now failing NPD project. We were concerned about the believability and strength of this manipulation and decided that having the participants make a choice that appeared to have negative consequences was stronger than

simply telling them that they had chosen to begin the project. Also, we considered using a manipulation similar to that of Boulding, Morgan, and Staelin (1997) by providing very positive information to participants about a single project. This leads to a high percentage of "go" decisions. Then, in subsequent decisions, the information would turn negative (and identical to the low-PR condition). We decided against this manipulation since it could introduce biases (e.g., learning and contrast effects). Unlike the present study, Boulding et al. (1997) put all individuals in a high-PR condition.

10. It appears that individuals in the high-PR condition perceived the two products to be equal in attractiveness. There was scant information provided about the two products; there was little reason to believe that one product was more attractive (see Appendix B). The pretest and actual results show that individuals chose to develop each product about half the time. Also, reading through the open-ended justifications from participants revealed no systematic reason for choosing a particular product. Rather, personal preferences such as avoiding automobile accidents and possibly saving lives in the event of accidents led individuals to choose the antilock and air bag sensors, respectively. Difference of means tests showed no significant difference for eight of the nine dependent variables based on the participants' choice of product to develop ( $p < .05$ , two-tailed).

11. Managers were instructed to complete the decision-making experiment and not stop before reaching the end of the booklet. This was done for two reasons. First, we expected attrition as participants moved through the repeated decisions. To ensure sufficient sample size (and statistical power) in the latter stages of the experiment, we needed individuals to continue until they reached the end of the experiment. More important, our pretest results indicated that the participants might opt to stop the project simply because this would shorten the time to complete the exercise (which certainly is rational). We wanted to remove this incentive to stop early.

12. We also analyzed the data using repeated measures multivariate ANOVA (MANOVA) to test Hypotheses 1, 2, and 3. The results were substantively unchanged. For brevity, we report the results of the ANOVA analysis only.

13. We conducted covariate analyses to ensure the accuracy of the findings. The covariates were the number of years of work experience and NPD experience, as well as the largest dollar amount of allocation to a project for which the participant was the sole decision maker. Since the results did not change substantially, the findings are not reported in the final results. We also reanalyzed the data using gender as a between-subjects factor since Bateman (1986) found escalation of commitment to be greater for men than women. The results were unchanged.

14. In addition to asking managers how likely they were to fund the next stage, we had each participant make a dichotomous "go" or "no-go" decision. Since the likelihood of funding (FUND) construct captured the same underlying concept and provided more data, we reported those results earlier and supplement them here with information about the dichotomous decision.

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