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Information Distribution, Utilization, and Decisions by New Product Development Teams*

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Typically, organizations use new product development processes composed of activities followed by decision points, where projects are continued or abandoned. A decision maker likely possesses some common information also held by other decision makers and some unique information (that only she/he possesses). If a team relies mainly on overlapping, or common, information, decisions may suffer, but if they share and utilize information originally possessed by a subset of individual members, better decisions can be made. In this paper, the authors designed and conducted four studies to examine the effects of information distribution and utilization on new product team decision-making. In study 1, the findings show that team members tend to use information possessed by everyone (i.e., common information) but neglect critical information possessed only by one of them (i.e., unique information). This common information bias results in suboptimal new product continuation decisions. In study 2, the interplay between the common information bias and team commitment to the NPD project favored by unique information is examined. The results show that although commitment influences new product development team decisions, the common information bias is stronger. Study 3 was conducted to rule out an alternative explanation for the effect of information distribution—the perception of information importance. In study 4, the focal hypotheses were re-tested using a different sample to add confidence in the findings.

> *"The information that life serves is not necessarily the information that one would order from the menu, but like polite dinner guests and other victims of circumstance, people generally seem to accept what is offered rather than banging their flatware and demanding carrots." (Gilbert, 1998, p. 126)*

Introduction

A large proportion of organizations use idea-to-launch methods, such as the Stage-Gate®[1] system, to develop new products, in which activities (stages) are followed by decision points (gates) (Cooper, 1990). Much of the body of research has centered on the stages of the process (Barczak, Griffin, and Kahn, 2009; McNally and Schmidt, 2011); however, in this paper, the focus is on the gates, where new product development (NPD) projects are continued or abandoned.

New product development continuation decisions normally are team decisions (Cooper, 2008; Marinova, 2004). Relative to individual decision makers, teams offer several benefits, including expanding available information (Troy, Hirunyawipada, and Paswan, 2008), coordinating separate cognitive activities (Madhavan and Grover, 1998), integrating various functional expertise (Edmondson and Nembhard, 2009), and fostering collective assessment for new product success (Schmidt, Montoya-Weiss, and Massey, 2001).

Despite these benefits, the assumptions are that (1) information is equally distributed among and (2) is fully utilized by team members. However, individuals have different information sources, functional backgrounds, role demands, work experiences, and professional training. This results in them possessing overlapping, but not identical, information (Biyalogorsky, Boulding, and Staelin, 2006; Winquist and Larson, 1998). It has been suggested that team members use only a portion of the available information, thereby decreasing decision quality (Hammond, Ralph, and Raiffa, 2006). They frequently discuss information that they commonly hold but fail to utilize unique information possessed by a subset of the team (Bazerman and Chugh, 2006; Winquist and Larson, 1998).

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[1] Stage-Gate® is a registered trademark of the Product Development Institute Inc.

In this paper, the authors report on four studies that examine information distribution, utilization, and decision-making by new product teams. Studies 1 and 2 test the research hypotheses while studies 3 and 4 add credibility to the findings.

In study 1, in the test condition, decision makers each held a portion of the favorable information about a superior new product option (i.e., unique information), but they possessed identical (i.e., common) information about an inferior new product option. To make an optimal decision, team members needed to utilize this unique information. However, the results show that teams overrely on common information and thus make suboptimal decisions; this is labeled "common information bias."

In study 2, we examined whether teams' information use and new product continuation decisions differed based on their commitment to the NPD project favored by unique information. For instance, a number of studies have found that managers' prior beliefs generate a commitment bias (e.g., Boulding, Morgan, and Staelin, 1997; Schmidt and Calantone, 1998, 2002) and "such 'belief-based' information can be contrasted with the 'data-based' information that routinely flows through most organizations" (Hutchinson, Alba, and Eisenstein, 2010, p. 627). By conducting a longitudinal study, team commitment (high commitment [HC] versus low commitment [LC]), was studied for the unequal information distribution (UID) condition. In study 3, two follow-up examinations were conducted to rule out an alternative explanation for the effect of information distribution—the perception of information importance. In study 4, the focal hypotheses were re-tested using a different sample to add confidence in the findings.

BIOGRAPHICAL SKETCHES

Dr. Haisu Zhang is an assistant professor of marketing at Purdue University Calumet. He received his Ph.D. in business administration (marketing) from the University of Illinois at Chicago. His research centers on new product development, marketing-innovation interface, decision-making, organizational learning, and international marketing. His work has been published in *Journal of International Marketing*, and presented at American Marketing Association Winter/Summer Marketing Educators' Conference, Product Development and Management Association Annual Global Conference on Product Innovation Management, and Annual Society for Industrial and Organizational Psychology Conference.

Mr. Timothy M. Basadur is an assistant professor of management at Concordia University Chicago. His research interests include topics that can be said to fall under managerial cognition including individual and organizational creativity, motivated cognition, and social network analysis. His research is published in *Journal of Applied Behavioral Science* and *Psychology of Aesthetics, Creativity, and the Arts*, as well as in various book chapters focused on creativity. Tim also delivers and leads applied creativity projects for organizational clients including Goodrich Corp., John Deere, Oshawa Foods Group, Institute For Thermal Processing Specialists, Pfizer Consumer Healthcare, and Bell Canada, among others.

Dr. Jeffrey B. Schmidt is an associate professor of marketing at Michael F. Price College of Business, University of Oklahoma, 307 W. Brooks Street, Norman, OK 73019-4001 where he teaches new product development and conducts research in this area. He received his Ph.D. from Michigan State University, his M.B.A. from Oakland University in Rochester, Michigan, and his B.S. (with honors) from Michigan State University. Prior to returning to school to pursue his Ph.D., Jeff worked as a project engineer for a "Detroit Three" automobile manufacturer. His primary research interests are new product development, product strategy, and managerial decision-making. Jeff has co-authored a dozen articles published in *Journal of Product Innovation Management*. Some of his other research has been published in *Decision Sciences*, *Journal of International Marketing*, *Journal of the Academy of Marketing Science*, *Marketing Science*, and others. He served on the Board of Directors for the Product Development and Management Association and as the Vice President for Academic Affairs. Jeff likes to keep up with new technologies, especially consumer electronics, in his personal life.

Theoretical Background

Information and Decision-Making at NPD Review Points

Previous research shows that individuals often make suboptimal "go/stop" decisions during NPD; rather than stop NPD projects when the outcome appears poor, decision makers allow them to continue at higher levels of investment (Biyalogorsky et al., 2006; Boulding et al., 1997; Schmidt and Calantone, 1998, 2002). While most studies examine individual decision-making, Schmidt et al. (2001) find that teams make better NPD continuation decisions than individuals (i.e., they are less likely to continue failing NPD projects). Yet, in spite of the advantage, team decision-making is complex. The decision outcome is affected not only by individual factors but also by group dynamics and interpersonal relations that can confound the decision-making process.

Several streams of research shed light on the utilization of information in NPD teams, including market orientation (e.g., Slater and Narver, 1995), information processing (e.g., Brockman and Morgan, 2006), knowledge-based view (e.g., Madhavan and Grover, 1998), and cross-functional integration (e.g., Troy et al., 2008). They generally suggest that decision makers can acquire, share, and interpret new information to improve decisions.

Typically, the assumption is that team members share and fully utilize all pertinent information; frequently this does not hold (Bazerman and Chugh, 2006; Hammond et al., 2006). Either some portion of critical information is not shared among team members (Marinova, 2004), or even if it is, decision makers frequently are unable to take new information into consideration (Sethi and Iqbal, 2008).

Another issue is that team members use common information more than unique information to make decisions (e.g., Steinel, Utz, and Koning, 2010; Wittenbaum, Hubbell, and Zuckerman, 1999; Wittenbaum, Hollingshead, and Botero, 2004). The common information bias has been found in different decision tasks, such as drug selection (Larson and Harmon, 2007), murder mystery investigation (Steinel et al., 2010), and political campaigns (Parks and Nelson, 1999). Bazerman and Chugh (2006) suggest that the common information bias is prevalent in a wide variety of real-world situations where teams must make "yes/no" decisions; we extend this research to the NPD area and explore related issues.

Drawing from the social psychology literature, the focus is on the examination of how information use influences teams' new product decision-making. Also, commitment to an NPD project, a team-level characteristic (Schmidt et al., 2001), is used to understand differences in information use for HC and LC teams.

Study 1: Information Distribution and New Product Decision-Making

Hypothesis Development

NPD gates have three components: deliverables (or information such as reports and forecasts), hurdles (criteria), and continuation decisions. Decision makers use the information, at least to an extent, to make their decisions.

> *H1: Team new product development (NPD) project continuation decisions are related to the use of information.*

Decision makers tend to rely on common information, possessed by all decision makers. The three reasons for this are discussed briefly.

First, common information can be socially validated (Stasser, 1992). Uncertainty often arises about the meaning, implication, and accuracy of information in group discussions. It is impossible for decision makers to recall and process all relevant information, so in such uncertain situations, they often evaluate the information with each other (Wittenbaum et al., 2004). Only common information, shared by every team member, can be socially validated.

Second, common information can result in mutual enhancement, a process where team members establish enhanced evaluations of each other's task-relevant capabilities (Wittenbaum et al., 1999). When one communicates common information in a group discussion, the parties' information pools are validated, and they perceive themselves as being more competent and knowledgeable about the decision task. In this sense, common information helps establish a base where team members acknowledge and relate to each other (Clark and Brennan, 1996).

Third, individuals have limited capacity to recall information. When one team member presents common information, it is easier to elicit collective attention, and others are able to recall that information. In contrast, when unique information is introduced, it is new to other team members, and their memories are not strengthened. As a result, decision makers generally remember more common information than unique information in group discussions (Larson and Harmon, 2007). When it comes to making decisions, NPD teams more easily achieve consensus if they rely on information possessed by all members. In this sense, shared memorability traps them in the range of common information. This leads to the second research hypothesis.

> *H2: In unequal information distribution (UID) conditions, new product development (NPD) teams use common information more than unique information for making continuation decisions.*

The content of team discussions influences decisions. Researchers find that in group discussions, (1) decision makers recall common, as well as unique, information; (2) in general, they recall more common information than unique information; and (3) common information is mentioned more in the earlier stages of discussions and unique information more later (Larson, Foster-Fishman, and Keys, 1994; Wittenbaum et al., 2004). However, the tendency to base decisions on common information is not influenced by discussion content (Larson and Harmon, 2007). In other words, even though team members mention unique information in group discussions, they still rely on common information to make decisions. In this sense, NPD decisions may not be directly related to the information mentioned in group discussions, but instead result from the actual use of specific information. As H2 states, decision makers tend to use common information, and thus, a decision bias may exist when information is unequally distributed. We expect NPD decision teams in the unequal distribution (IUD) condition to continue the project that is favored by common information although a superior option exists if they share information.

H3: In unequal information distribution (UID) conditions conditions, more teams continue the new product development (NPD) project supported by common information than the project supported by unique information.

In the equal information distribution (EID) condition, every decision maker holds the same set of information. No matter which piece of information is shared in group discussions, it can be socially validated and enhance decision makers' perceptions of their task-related capabilities. Thus, a team can fully use all of the available information and eventually discover that in total, there is more information favoring one NPD project. The common information bias is, to a large degree, reduced in the EID condition. As a result, more decision-making teams in the EID condition are expected to continue the superior NPD project than in the UID condition.

H4: Teams make better new product development (NPD) decisions in equal information distribution (EID) conditions relative to unequal ones.

Research Design

For this study, a scenario similar to Schmidt and Calantone (1998, 2002) was designed, and it was based on a fictional manufacturing company in the automobile industry. The company was said to be developing two new products—Vehicle Weight Sensor and Driver Reflex Sensor. The scenario included company background, NPD process, brief product descriptions, and forecasted performance for these two projects, as detailed in Appendix A.

Individuals were randomly assigned into three-person teams and played the role of decision makers. Due to budget constraints, the teams had to decide which one of the two projects to continue. This decision was based on 14 forecasted performance items recommended by Hart, Hultink, Tzokas, and Commandeur (2003), which lists important evaluation criteria used at NPD review points.

Numerical data were used for two reasons: (1) managers base many decisions on numerical data (Hutchinson et al., 2010); and (2) using only numbers eliminates the confounding effects that result from using multiple information formats, such as pictures and graphs (Nenkov, Inman, Hulland, and Morrin, 2009). Participants were provided with definitions for all information items to facilitate understanding. To eliminate the confounding effect of the perceived differences in importance of information, participants were instructed that all information is equally important. The effectiveness of this is explored in study 3.

In the EID condition, each team member had 14 items of identical (i.e., fully distributed) information (see Table A1 in Appendix A). We purposefully designed nine of the information items to favor the Vehicle Weight Sensor project and five items to favor the Driver Reflex Sensor project. With the premise that all information is equally important, the optimal decision would be to continue the Vehicle Weight Sensor project. A pretest with 79 individuals showed that more than 80% chose to continue developing the Vehicle Weight Sensor indicating that they perceived it to be superior to the Driver Reflex Sensor ($p < .001$).

In the UID condition, teams were provided the same 14 information items, but the information was distributed differently. Each team member was given only eight information items. We purposefully had the five information items which favor the Driver Reflex Sensor to be commonly held by all team members: profits, product performance, product advantage, customer retention, and market size. The other nine information items that favored the Vehicle Weight Sensor were evenly distributed among the three team members—that is, each decision maker possessed only three of the nine items of information that favored the Vehicle Weight Sensor. So, while each team member was provided with 8 of the 14 items of information, each team possessed the full set of information. To make the optimal decision, team members in the UID condition would have to be able to share and use information possessed by the other members.

Participants and Procedures

Data were collected over four semesters from junior and senior business students enrolled in one of six marketing or management courses at a large public Midwestern university. The exercise was integrated into the course content, but their participation in the study was voluntary. The exercise lasted approximately 50 minutes; the procedures are shown in Table 1.

Of 463 students registered in these courses, 329 agreed to participate. We later dropped some teams from the data set for the following reasons: one or more students (1) missed part of the exercise, (2) participated in the pretest, (3) did not consent to participate in the study, (4) participated in the exercise multiple times because they were registered in more than one of the courses used for our study, or (5) teams had fewer or greater than three people. In total, 79 three-person teams (237 participants) comprise the final data set (i.e., 37 in the EID condition and 42 in the UID condition). Fifty-four percent of respondents are male.

J PROD INNOV MANAG 2014;31(S1):189–204

Table 1. Procedure

Procedure	Task	Length
Step 1	Participants were given the exercise individually.	1 minute
Step 2	Participants read the scenario. They were presented with differing information depending on the condition to which they were assigned. See Appendix A. All other information in the scenario was the same.	15 minutes
Step 3	Participants returned the reading materials.	1 minute
Step 4	Each team was given decision-making sheets. Team members were instructed to have group discussion and answer a set of questions including making a team "go/stop" decision. Extra time was given to teams that did not complete the task after 25 minutes so that time constraints were eliminated.	25 minutes
Step 5	Each team returned the answer sheet and team members were given another sheet to answer individually.	1 minute
Step 6	In the new answer sheet, we asked participants to individually evaluate the group discussion.	7 minutes

Measures

Information use. After the group decision, team members collectively recalled and listed the information they used. They were not allowed to re-check any information once they had completed the original scenario. We calculated the percentages of information favoring each project. To examine if the ordering of information affects the decision outcome, the order of information was reversed for both the EID and UID conditions, and no significant difference was found ($p = .42$ for EID; $p = .90$ for UID). Consequently, overall results are reported.

Decision outcome. Continuation decisions were dummy coded (0 = Driver Reflex Sensor; 1 = Vehicle Weight Sensor). As the pretest shows, the information in total strongly favors the Vehicle Weight Sensor project. No significant difference in the decision outcome was found with respect to order of information presentation ($p = .81$ for EID; $p = .96$ for UID); overall results are reported.

Control variables. In this study, we took into consideration several aspects of team composition: work experience, NPD experience, automobile knowledge, sex, and work team history. In later analyses, we conducted a set of binary logistic regression and nonparametric tests. Due to the limited number of cases in each information condition, all control variables could not be considered simultaneously, so the sample was split into two groups—above and below average for work experience, NPD experience, and automobile knowledge. For sex, teams were dummy coded as being predominantly male or female. For work team history, teams were dummy coded as whether or not members had worked together previously in a team setting. Independent samples t-tests and Fisher's exact tests did not show any significant difference in the information use or decision outcome (ps > .05). As a result, we conclude that these variables will not confound our findings and thus disregarded them in later analyses.

Results

Support was found for H1, the baseline hypothesis; NPD project continuation decisions are related to team members' use of information. We conducted binary logistic regressions for the two information conditions. Results show that in both the EID condition ($\beta = -9.74$, Wald = 8.39, $p < .01$) and UID condition ($\beta = -13.80$, Wald = 4.74, $p < .05$), the greater the use of information that favored the Driver Reflex Sensor project, the less likely teams continue the Vehicle Weight Sensor project.

The results also support H2, H3, and H4. H2 states that in the UID condition, NPD teams rely more on common information than unique information for making "go/stop" decisions. As Figure 1 shows, only 38.6% of information favoring the Vehicle Weight Sensor (unique information) was used, and 61.4% of information favoring the Driver Reflex Sensor (common information) was

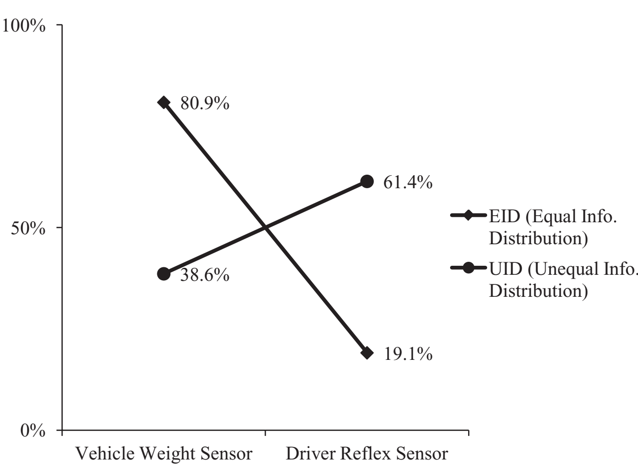

Figure 1. Information Use—Study 1

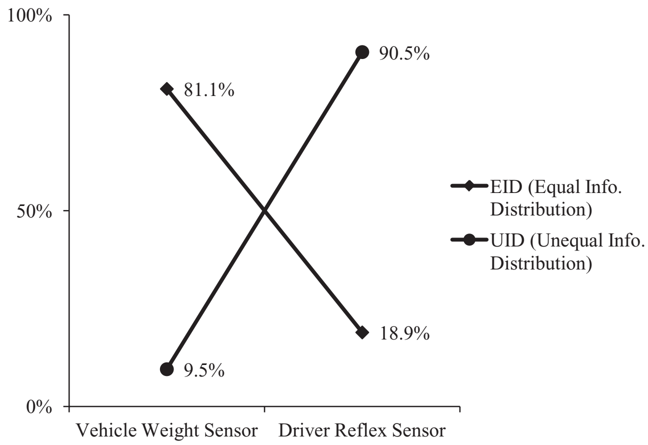

Figure 2. Decision Outcome—Study 1

used by the teams in the UID condition ($t[41] = -2.84$; $p < .01$). The third hypothesis predicts that in the UID condition, more teams continue the inferior NPD project supported by common information. As Figure 2 shows, 90.5% of teams ($n = 38$) selected the Driver Reflex Sensor project to continue compared with 9.5% of teams ($n = 4$) that selected the Vehicle Weight Sensor ($\chi^2[1, n = 42] = 27.52$, $p < .001$). H4 predicted that more teams decide to continue the superior project (Vehicle Weight Sensor) in the EID condition than in the UID condition. As Figure 2 shows, 81.1% of teams in the EID condition continued the Vehicle Weight Sensor project, while only 9.5% of teams in the UID condition made the same decision. We conducted a two-way chi-square analysis and found a significant difference between the two conditions ($\chi^2[1, n = 79] = 41.09$, $p < .001$).

Study 2: When Information Distribution Meets Commitment

Hutchinson et al. (2010) suggest that commitment influences the decision outcome. Whereas in study 1, the focus was data-based information in two information distribution conditions, in study 2, the focus is determining how a team's information use and decision outcome vary based on team commitment to an NPD project.

Hypothesis Development

Individuals have limited ability to process information; as commitment to a project increases, the tendency is to seek out and focus on positive information associated with projects that match their expectancies and values (Brockner, 1992; Hammond et al., 2006). Even when a project is considered relatively inferior by decision makers, heightened commitment may lead them to use filtered information to rationalize project continuation decisions (Boulding et al., 1997; Caldwell and O'Reilly, 1982).

In the present research, we intentionally induced teams' commitment to the Vehicle Weight Sensor (HC) in the UID condition.[2] Recall that the Vehicle Weight Sensor is favored only by unique information, and this project is superior to the Driver Reflex Sensor only if unique information is considered. Since, in the HC condition, team commitment to Vehicle Weight Sensor was induced, it is expected that teams will use more unique information when making decisions than do LC teams. Because the decision outcome is determined by information use, we expect that HC teams will make better decisions.

H5: High-commitment (HC) teams rely more on unique information than low-commitment (LC) teams for making new product development (NPD) continuation decisions.

H6: High-commitment (HC) teams are more likely to continue the superior new product development (NPD) project favored by unique information than low-commitment (LC) teams.

H5 and H6 state our expectations about the differences between LC and HC teams. However, a question still remains: For HC teams themselves, does the common information bias still exist? In other words, which has a stronger impact on the decision outcome—common information (which directs teams to select the inferior Driver Reflex Sensor project) or high commitment (which directs teams to select the superior Vehicle Weight Sensor project)?

One the one hand, Biyalogorsky et al. (2006) examine decision makers' persistence with NPD projects. They summarize three reasons why commitment occurs in organizations. (1) Decision involvement inertia: NPD managers keep making decisions persistent with their initial decisions; (2) decision involvement distortion: NPD managers' initial decisions influence their belief structures, which enable persistent decisions; (3) belief inertia distortion: New information fails to sufficiently update NPD managers' belief structures, resulting in persistent decisions. Biyalogorsky et al. (2006) find that belief inertia distortion is the strongest driver of commit-

[2] We could have induced high commitment to either (1) Driver Reflex Sensor or (2) Vehicle Weight Sensor. As for (1), it would be no surprise that teams would still select the Driver Reflex Sensor project, because both commitment and common information favor it. In Study 2, we were interested in (2): What decisions do teams make if high commitment favors Vehicle Weight Sensor but common information favors the Driver Reflex Sensor project?

ment. Recall that our research interest is to examine the information use and decision outcomes when teams increase their commitment to the Vehicle Weight Sensor project (favored only by unique information).

In line with the notion of belief inertia distortion, we intentionally built up participants' belief structures for the Vehicle Weight Sensor early in the exercise (discussed in greater detail in the next section) and later provided them with new information (i.e., the 14 information items in Appendix A). The new information contradicts their beliefs as the common information favors the Driver Reflex Sensor project. Because of heightened commitment, decision makers may seek positive information to support their initial beliefs (here, continuing the Vehicle Weight Sensor project) and ignore the implications of other information (Caldwell and O'Reilly, 1982; Lord, Ross, and Lepper, 1979). Since all positive information about the Vehicle Weight Sensor is unique, HC teams may seek out and use unique information to make their decisions.

On the other hand, the team process can complicate information-processing mechanisms. Although team members may hold different information, they may feel pressured to conform to the views of others. In this sense, team members are "forced" to pay attention to socially validated (i.e., common) information. Furthermore, researchers have found that common information is raised in early group discussions, while unique information is raised later (Larson et al., 1994). Thus, common information may facilitate the establishment of an early consensus among team members. If so, unique information, even though mentioned in group discussions, may be superficially considered (Schmidt et al., 2001).

Two streams of research provide conflicting views. One indicates that HC teams increase their tendency to use unique information; the other claims that they will continue to use common information for decision-making. While it seems that the two factors, commitment and information distribution, exert opposite effects on decision-making, we wonder which effect is stronger. Thus, two research questions are raised and tested.

RQ1: In the unequal information distribution (UID) condition, do high-commitment (HC) teams use more common information or unique information for new product development (NPD) continuation decisions?

RQ2: In the unequal information distribution (UID) condition, do high-commitment (HC) teams decide to continue the superior new product development (NPD) product project (favored by unique information), or the inferior one (favored by common information)?

Research Design

For this study, the decision-making exercise was changed. In study 1, teams made a single new product decision. Due to the isolated nature of the decision context, the commitment levels of these participants to the NPD project in question can be said to be low. Thus, in study 2, we used the participants in the UID condition of study 1 as LC teams. To develop HC in this study, we designed an exercise that included three group meetings held every other day. The first two meetings were designed to build team commitment to the Vehicle Weight Sensor project. In the third meeting, the Driver Reflex Sensor was introduced so that the information and experimental operations at that point were identical to those used in study 1. In other words, the common information favored the Driver Reflex Sensor but the total (distributed) information favored the Vehicle Weight Sensor. Participants and procedures are detailed next.

Participants and Procedures

Participants. In the HC condition, junior and senior undergraduates in the business school at a large public Midwestern university participated in this study as a project to earn course credit in one of three marketing courses. Students participated in the decision-making project as part of the course requirements. Data collection lasted three semesters. One hundred twenty-four students registered in these courses, and 115 allowed us to use their responses. Participants were randomly assigned into three-person teams. We later removed several teams from our analyses for one of the same reasons mentioned in study 1. In total, 33 three-person teams, containing 99 participants (49 female), contributed their responses to this study.

Procedures. In the HC condition, participants met face-to-face three times to make three gate decisions. Figure 3 outlines the procedures. At review point 1, participants were responsible for making initial investment decisions for two NPD projects: the Vehicle Weight Sensor and the Headlight Beam Luminosity Variator. They were told that another (fictional) team was responsible for two other projects. At review point 2, every team terminated the Headlight Beam Luminosity Variator project and invested in the Vehicle Weight Sensor project due to the preponderance of information that favored the latter. Making "go" decisions on and investing in a project raises decision makers' commitment to that project (Schmidt and Calantone, 1998, 2002). Thus, we

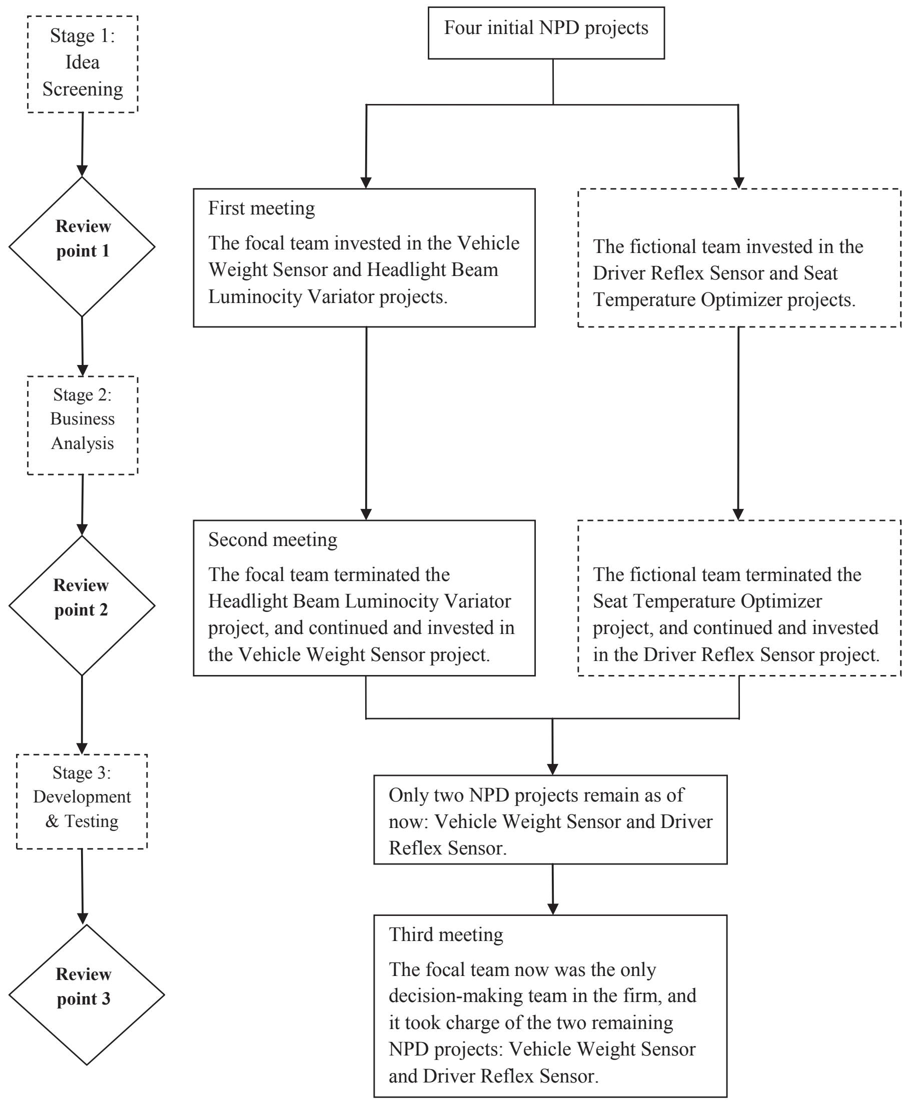

Figure 3. Experimental Design for the High-Commitment (HC) Condition in Study 2
Note: The longitudinal experiment reflects the NPD process. Participants went through three review points. They were told that there was a development stage before each review point, and that at each stage the project team prepared the performance forecast report for the review team. Boxes in dashed line are fictional stages or teams. Boxes in solid line are the actual experimental procedure.

expected team commitment to Vehicle Weight Sensor to increase after making decisions favoring it at the first two review points (see Figure 3). At review point 3, the participants were instructed that the chief executive officer (CEO) had downsized the decision-making teams and that their team was now responsible for the two remaining NPD projects: Vehicle Weight Sensor and Driver Reflex Sensor. In this meeting, the projects, information distribution condition, and procedures were identical to those in the UID condition of study 1: Driver Reflex Sensor was favored by common information. The only difference is that team commitment to Vehicle Weight Sensor was expected to have increased due to "go" decisions and investment made at review points 1 and 2. At this point, HC in the UID condition was induced.

Measures

Schmidt and Calantone's (2002) commitment measures were adapted (Appendix B). We computed Cronbach's alphas (α), composite reliability, and the average variance extracted, and deemed the results satisfactory.

Manipulation Check

Commitment was successfully manipulated; it was higher in teams that made previous "go" decisions for the

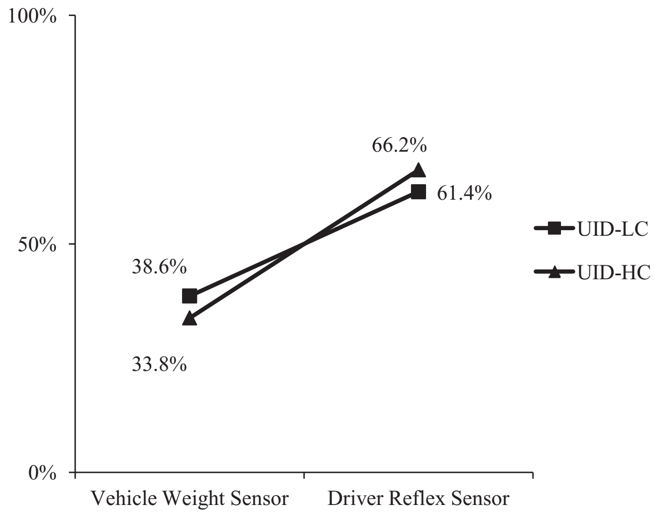

Figure 4. Unique Information Use—Study 2

Vehicle Weight Sensor project. Results of an independent samples *t*-test show that commitment in the longitudinal exercise was higher than that in the single-meeting one (M = 4.93, standard deviation [SD] = 1.43 versus M = 2.66, SD = 1.06, respectively, $t[73] = 7.89$, $p < .001$).

Results

H5 posits that HC teams rely more on unique information than LC teams for making new product continuation decisions. No support was found ($t[73] = .68$, $p = .50$). There is no significant difference in the quantity of unique information use by HC and LC teams (see Figure 4). Possible reasons for this are offered below.

H6, which states that more HC teams continue the superior project than do LC teams, was supported. As Figure 5 shows, 27% of HC teams made the optimal decision, while only about 10% of LC teams did so. The two-way chi-square analysis indicated that the difference was significant ($\chi^2[1, n = 75] = 4.06$, $p < .05$).

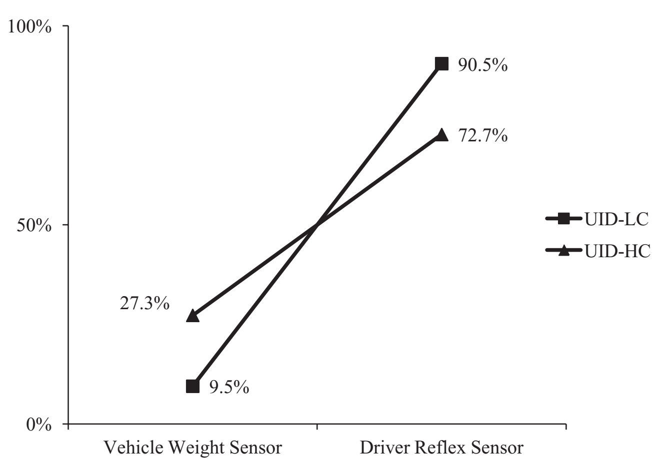

Figure 5. Decision Outcome—Study 2

RQ1 and RQ2 examine how biases in terms of the information use and decision outcome occur when team commitment varies. As Figure 4 shows, in the HC condition, 34% of the used information was unique, while 66% was common ($t[32] = -2.63$, $p < .05$). While nine (27%) teams continued the Vehicle Weight Sensor project, 24 (73%) teams continued the Driver Reflex Sensor project ($\chi^2[1, n = 33]) = 6.81$, $p < .01$) (see Figure 5).

In summary, HC teams use more common than unique information, and more teams make suboptimal decisions by continuing the Driver Reflex Sensor project. This suggests that the information distribution effect is stronger than that of team commitment on decision-making.

Additional Analysis

Compared with LC teams, the results show that HC teams made better decisions; however, one could reason that HC teams (i.e., the three-session exercise) may form a different team process from LC teams (i.e., single-meeting exercise). While team process includes a range of facets, cohesiveness is a good proxy since it sums overall intragroup mechanisms (Barrick, Stewart, Neubert, and Mount, 1998) and results, partly, in team effectiveness (Brockman and Morgan, 2006). We measured cohesiveness by adapting O'Reilly, Caldwell, and Barnett's (1989) scale items (5-point scale; shown in Appendix B). We found that LC teams (M = 4.55, SD = .45) and HC teams (M = 4.64, SD = .38) did not differ in terms of cohesiveness ($t[73] = -.85$, $p = .40$). As a result, the team process did not confound our findings in this research.

Which Matters More, Common Information or Team Commitment?

We found that although a majority of teams made suboptimal decisions (RQ2), the decision outcome was different in the HC condition compared with the LC condition (H6). While we anticipated that commitment to the Vehicle Weight Sensor project would drive teams to use the unique information, the results showed no significant difference in information use between the two commitment conditions. We maintain that this is due to two possible reasons. First, it is likely that the effect of UID was so strong that it led decision makers to rely mostly on common information, regardless of their commitment levels. Second, teams' commitment to an NPD project may have resulted in their mentioning information favoring that project more frequently in group discussions.

However, information sharing frequency does not affect the actual use of that information in the UID condition (Larson et al., 1994). That is, team members may have shared their own unique information about the Vehicle Weight Sensor project, but they still ended up basing their decisions on common information.

We proposed that HC teams made different decisions due to their dependence on more unique information. However, the unexpected results raise a question: If the use of unique information did not increase in the HC condition, what motivated more HC teams to continue the Vehicle Weight Sensor project? To answer this question, we ran two binary logistic regression models, model 1 with only (common) information use and model 2 with information use and commitment. To maximize the estimation power, we disregarded the constant in model testing because of the small subsample size of teams that selected the Vehicle Weight Sensor project. Model 1 indicates that common information use is negatively related to the decision outcome (β = −3.08, Wald = 10.62, $p < .01$) and that Cox & Snell R^2 is .49. Model 2 indicates that both information use (β = −10.82, Wald = 4.54, $p < .05$) and commitment (β = .84, Wald = 4.00, $p < .05$) are related to the decision outcome, and that Cox & Snell R^2 is .67. This indicates that information use explains 49% of the variance of the decision outcome and that commitment explains another 18%. These findings provide two insights: (1) commitment can directly influence the decision outcome regardless of information use; and (2) the use of common information is a more influential factor than is commitment. This explains the change in decision outcome by HC teams, as well as the persistence of the common information bias.

Study 3: Information Importance

In studies 1 and 2, it was found that decision-making teams rely more on common than unique information. One may argue that this is due to individuals perceiving the categories of common information as being more important prior to group discussions.

We were mindful of this potentiality and employed two strategies to address this issue. First, participants were instructed that all information was equally important. Second, two follow-up examinations were conducted two months after the focal exercises. In the first follow-up study, we sampled 123 of the 225 participants who had previously participated in the UID condition, including both LC and HC teams. We presented the full set of information (used in the EID condition in Appendix A) and asked them to assess two NPD projects and decide which to continue based on the performance forecast. We told them that this was a separate exercise and titled the projects respectively "project A" and "project B" to reduce memory bias. If participants simply perceived the five items of common information as being more important, in this follow-up study (given all the fourteen items of information), they would likely neglect the nine items of information favoring project A (Vehicle Weight Sensor) and, basing their decisions on the other five items of information, continue project B (Driver Reflex Sensor). However, results show that 109 participants (88.6%) decided to continue project A ($\chi^2[1, n = 123] = 73.37$, $p < .001$).

In the second follow-up study, we sampled another 24 participants in the previous UID condition. We provided them with only the titles of the 14 items of information (without the numerical data). Rather than instruct them that all information is equally important, they were asked to rank information (1 = most important, 14 = least important) for NPD decision-making. To reduce memory bias and hypothesis guessing, it was explained that this was a separate exercise. A Friedman test showed that financial performance (profits) and market performance (market share) were considered the most important items of information. Although profits were a common information item, the other four common information items were perceived to be of average importance. This suggests that the importance of common information is unlikely to confound the effect of information distribution. To further investigate this issue, the two most highly rated information items were removed and information use was re-calculated (based on the 12 remaining information items). Then the related hypotheses (H1, H2, and H5) and RQ1 were re-tested. Results were consistent with previous findings. Thus, the instructions about the equal importance of the information were effective, and participants did not overweigh the importance of the common information items prior to group discussions.

Study 4: Adding Confidence to the Previous Findings

In the analysis of control variables, we found that professional experience was not related to the decision outcome. Prior research has also found that that professional experience may not significantly affect decision outcomes and/or reduce decision biases (Biyalogorsky et al., 2006; Chandy, Prabhu, and Antia, 2003; Christensen et al., 2000; Hutchinson et al., 2010; Mittal, Ross, and Tsiros, 2002; Schmidt and Calantone, 2002). Nonetheless, to validate our research results, study 4 was conducted using an M.B.A. sample. These participants had an average of 5.8 years of professional work experience.

First, in a study similar to the pretest, 22 M.B.A. students participated, and the results show that significantly more individuals considered the Vehicle Weight Sensor superior to the Driver Reflex Sensor (i.e., 17 versus 5; 77.3% versus 22.7%; $\chi^2[1, n = 22] = 6.55$, $p < .05$). We ran a two-way chi-square analysis and found no significant difference between M.B.A. and undergraduate students in the pretest ($\chi^2[1, n = 101] = .32$, $p = .57$). We also asked participants to rate the success of each sensor (7-point scale), and found that they perceived the Vehicle Weight Sensor (M = 5.86, SD = .99) more likely would be successful than the Driver Reflex Sensor (M = 4.77, SD = 1.11) ($t[21] = 4.29$, $p < .001$). Comparing this with the undergraduate sample, we did not find significant differences for either sensor ($t[106] = .95$, $p = .34$ and $t[106] = .09$, $p = .93$ respectively).

Since the one-meeting UID condition is used in both studies 1 and 2, we decided to use it for a team-level validity check. We used the same materials (Appendix A) and the same procedures (Table 1) to examine M.B.A. teams' information use and decision outcomes. Forty-eight M.B.A. students participated in this study, resulting in 16 three-person teams. Results show that while 30.8% of the information teams used was unique, 69.2% was common ($t[15] = 2.54$, $p < .05$). While one team decided to continue the Vehicle Weight Sensor, 15 teams made the opposite decision, and the difference was significant ($\chi^2[1, n = 16] = 12.25$, $p < .001$). Furthermore, we compared these findings with those in the UID condition of study 1, and found no significant difference for either the information use ($t[56] = .98$, $p = .33$) or decision outcome ($\chi^2[1, n = 58] = .16$, $p = .69$).

General Discussion

This research sheds light on team-based decision-making and provides evidence that when information is unequally distributed among decision makers, there exists a common information bias resulting in suboptimal decisions. Additional findings indicate that while a higher level of commitment affects team decisions, overall, the common information bias is stronger. This paper has implications for researchers and managers; they are discussed next.

Research Implications

This research makes four theoretical contributions. First, to the best of our knowledge, this is the first research to examine how information distribution impacts NPD continuation decisions. By adopting a social psychology perspective, information distribution was found to be a crucial factor in the decision-making process. Prior research often assumes that information is fully distributed in a team. We challenge this assumption and find that decision makers at NPD review points tend to exhibit bounded awareness in that they tend to overrely on common information at the expense of unique information. Common information is used nearly twice as much as unique information. Future research needs to explore ways to encourage information utilization when critical information is possessed by a sample of the decision-making team. In addition, prior research has often overlooked the underlying mechanisms in the decision-making process (Slotegraaf and Atuahene-Gima, 2011). This research examines team decision-making in a micro way and highlights information use as a fundamental mechanism affecting the decision outcome. In this sense, we extend the NPD literature by adding a new insight into information use in team decision-making.

Second, research on NPD decision-making has been limited (McNally and Schmidt, 2011), and the focus on NPD review practices has been even less (Schmidt, Sarangee, and Montoya, 2009). The four studies in this paper investigate team decision-making at NPD review points and therefore contribute insights into new product decision-making whereas past studies focus primarily on individual decision-making (Schmidt et al., 2001).

Third, the findings here confirm the role of commitment in decision-making. A higher level of commitment increases the likelihood of continuing a particular project. Based on the current research, it appears that commitment can improve decision-making in some instances (e.g., when managers are committed to a superior project favored by unique information). On the other hand, commitment can be problematic (e.g., situations where managers are committed to an inferior project favored by common information). Thus, commitment should be considered as a double-edged sword.

Fourth, in this paper, we follow the hidden profile paradigm in social psychology, which focuses on the effect of information distribution on decision-making. We extend this paradigm by examining a new context: NPD. The findings not only confirm the negative effect of UID on team decision-making in study 1, but also extend the hidden profile literature by adding commitment as a moderator in study 2. According to the results, the common information bias can exceed the commitment bias to direct the decision-making process. These insights reinforce the importance of past and future research on information distribution. Especially promising is research that can test methods to encourage information sharing and utilization by team members.

Managerial Implications

The role of decision-making teams at first glance appears to ensure rational decision-making; however, this is not always the case. Bazerman and Chugh (2006) claim that managers are often trapped in bounded awareness: "Cognitive blinders prevent a person from seeing, seeking, using, or sharing highly relevant, easily accessible, and readily perceivable information during the decision-making process" (p. 90). More severely, most managers do not recognize the specific ways in which their awareness is limited. In line with this notion, our research suggests that team decision-making can lead decision makers to common information but away from unique information. It is notable that this phenomenon differs from information overload or having to make decisions under time pressure (Bazerman and Chugh, 2006). In our studies, participants received a manageable amount of information in a concise format and sufficient time for group discussions. Even so, most teams failed to bring the right information into their consensus. This implies that managers have a limited ability to fully process information.

Thus, we provide some recommendations on how to improve teams' information use. First, managers responsible for assembling NPD review teams should develop socialization strategies that reduce the various barriers to effective information use. Stasser and Birchmeier (2003) find that successful coaches, in addition to assembling a team of athletes, design and implement a game plan that enables the athletes to play well together. Likewise, the authors emphasize the importance of such a "game plan" in decision-making teams. They argue that it is unrealistic to assume that simply assembling a group of knowledgeable people will result in effective decision-making. Managers should design team structures and processes to promote effective socialization, which in turn facilitates communication among team members. In order to surface and appreciate unique information, managers should have a trusting and caring atmosphere and establish the appropriate discussion etiquette at the outset. Such socialization enables open, active participation that can overcome the bias toward shared information. Furthermore, the socialization strategies can be either formal or informal. For example, the rules of discussions can be formally displayed in multiple locations so that team members can see them, making it clear how they are expected to think and interact. An example of the informal approach is that Honda's managers set up unofficial meetings in which participants learn the appropriate cognitive and behavioral etiquette before they join in the decision-making process (Nonaka and Takeuchi, 1995).

Second, we recommend that members in the decision-making teams receive training on how to properly structure and conduct group discussions. Bazerman and Chugh (2006) suggest that increasing managers' ability to see, seek, share, and use information is critical to overcoming interpersonal awareness boundaries. Training can provide managers with the ability to successfully work with each other in a variety of ways, such as structuring review meetings, advancing skills adhering to team meeting etiquette, and developing techniques for surfacing and accurately assessing unique information. Schmidt et al. (2001) discussed using asynchronous media to share information and make better NPD continuation decisions.

Third, we recommend that skilled facilitators be employed so that managers can focus on *what* optimal decisions may be, while facilitators focus on *how* managers interact to actually make decisions. For example, Boeing utilizes facilitators to improve effectiveness of team meetings, and developed its TeamSpace system to perform many facilitator responsibilities for diverse teams (Lipford and Abowd, 2008). Decision-making teams frequently benefit from the guidance and encouragement of skilled facilitators to ensure active participation and equal assessment of information (Riek, 2001). Facilitators can serve to guide group discussions, rather than make it managers' responsibility to police their own decision-making processes. Among the benefits of employing a facilitator is that he or she can control how frequently information is discussed, as well as who speaks and who listens, to ensure that all voices are heard and that unique information is surfaced and considered.

Limitations and Future Research Directions

This research has some limitations, as does all research. These limitations represent future research opportunities and are noted next.

First, all four studies in this paper used experiments with student participants, which limits the external validity. It is impossible to simulate multimillion dollar NPD projects that take years to complete. However, it would have been nearly impossible to test the research hypotheses with any other method. Furthermore, even quasi-experiments in actual organizations would be extremely difficult to conduct. Even if organizations granted us permission to participate in their NPD projects, it would take years to complete such a study. Additionally, the sample size likely would be too small to provide enough statistical power for our tests.

Concerns about the choice to use experiments with student subjects should be reduced for a few reasons. First, many prior decision studies have presented similar results between experiments and field studies (e.g., Chandy et al., 2003; Mittal et al., 2002). Second, similar results have been found when using students and managers as subjects (e.g., Biyalogorsky et al., 2006; Hutchinson et al., 2010). In a similar experiment, Schmidt and Calantone (2002) found that work experience and NPD experience were not significantly associated with NPD project continuation decisions. Third, study 4 purposely used M.B.A. students. The results supported our earlier studies. Given the research problem, experiments are the ideal method, and for reasons above, concerns about the use of student subjects as decision makers should be alleviated.

Second, the design of the information distribution in our experiments caused a dominant bias toward one particular project choice. Our intention is to show the potential existence of the common information bias when information is not equally distributed. However, actual NPD situations are more complex. For example, team members may possess different amounts of information, unique information may not be possessed by every manager, information loads are larger in real-world decision tasks, and managers may be restricted from accessing certain information. Researchers should consider investigating these different information conditions.

Third, although we controlled for the importance of information, in practice, managers are likely to weigh some information categories more heavily than others. Also, the importance of information may change across NPD review points (Hart et al., 2003) and, further still, the items of information may be interrelated. To fulfill the need to design 14 items of information and unequally distribute them among decision makers, we assume that the items of information are independent of each other. Future research should explore how the importance and interdependence of information impacts team decision-making.

The experiment was designed in a way that each team member had a complete information set about the two NPD projects in the case of EID, but in UID each team member only had a subset of the information about the NPD projects. The subset favors the inferior project. We design the experiment in such a way to test the hypotheses. In actual NPD projects, UID conditions often exist: some information is overlapping (or common), and some is unique.[3]

Finally, we examined decision-making at one point of the NPD process. There is little reason to believe that the findings will not hold for other stages; this is left for future research.[4]

References

Barczak, G., A. Griffin, and K. Kahn. 2009. Perspective: Trends and drivers of success in NPD practices: Results of the 2003 PDMA best practices study. *Journal of Product Innovation Management* 26 (1): 3–23.

Barrick, M. R., G. J. Stewart, M. J. Neubert, and M. K. Mount. 1998. Relating member ability and personality to work-team processes and team effectiveness. *The Journal of Applied Psychology* 83 (3): 377–91.

Bazerman, M. H., and D. Chugh. 2006. Decisions without blinders. *Harvard Business Review* 84 (1): 88–97.

Biyalogorsky, E., W. Boulding, and R. Staelin. 2006. Stuck in the past: Why managers persist with new product failures. *Journal of Marketing* 70 (April): 108–21.

Boulding, W., R. Morgan, and R. Staelin. 1997. Pulling the plug to stop the new product drain. *Journal of Marketing Research* 34 (February): 164–76.

Brockman, B. K., and R. M. Morgan. 2006. The moderating effect of organizational cohesiveness in knowledge use and new product development. *Journal of the Academy of Marketing Science* 34 (3): 295–307.

Brockner, J. 1992. The escalation of commitment to a failing course of action: Toward theoretical progress. *Academy of Management Review* 17 (January): 39–61.

Caldwell, D. F., and C. A. O'Reilly. 1982. Response to failures: The effects of choices and responsibility of impression management. *Academy of Management Journal* 25 (March): 121–36.

Chandy, R. K., J. C. Prabhu, and K. D. Antia. 2003. What will the future bring? Dominance, technology expectations, and radical innovation. *Journal of Marketing* 67 (3): 1–18.

Christensen, C., J. R. Larson, A. S. Abbott, A. Ardolino, T. M. Franz, and C. Pfeiffer. 2000. Decision making of clinical teams: Communication patterns and diagnostic error. *Medical Decision Making* 20 (1): 45–50.

Clark, H. H., and S. E. Brennan. 1996. Grounding in communication. In *Perspectives on socially shared cognition*, ed. L. B. Resnick, J. M. Levine, and S. D. Teasley, 127–49. Washington, DC: APA.

Cooper, R. 2008. Perspective: The stage-gate idea-to-launch process—Update, what's new, and nexgen systems. *Journal of Product Innovation Management* 25 (3): 213–32.

Cooper, R. G. 1990. Stage-gate systems: A new tool for managing new products. *Business Horizons* 33 (May–June): 44–54.

Edmondson, A., and I. Nembhard. 2009. Product development and learning in project teams: The challenges are the benefits. *Journal of Product Innovation Management* 26 (2): 123–38.

Gilbert, D. T. 1998. Ordinary personology. In *The handbook of social psychology*, ed. D. T. Gilbert, S. T. Fiske, and G. Lindzey, 89–150. New York: Oxford University Press.

Hammond, J. S., L. K. Ralph, and H. Raiffa. 2006. The hidden traps in decision making. *Harvard Business Review* 84 (1): 118–26.

Hart, S., E. J. Hultink, N. Tzokas, and H. R. Commandeur. 2003. Industrial companies' evaluation criteria in new product development gates. *Journal of Product Innovation Management* 20 (January): 22–36.

[3] An anonymous reviewer noted this design artifact.

[4] The authors thank an anonymous reviewer for bringing this issue to our attention.

Hutchinson, J., J. Alba, and E. Eisenstein. 2010. Heuristics and biases in data-based decision making: Effects of experience, training, and graphical data displays. *Journal of Marketing Research* 47 (4): 627–42.

Larson, J. R., and V. M. Harmon. 2007. Recalling shared vs. unshared information mentioned during group discussion: Toward understanding differential repetition rates. *Group Processes and Intergroup Relations* 10 (3): 311–22.

Larson, J. R., Jr., P. G. Foster-Fishman, and C. B. Keys. 1994. Discussion of shared and unshared information in decision-making groups. *Journal of Personality and Social Psychology* 67 (3): 446–61.

Lipford, H., and G. Abowd. 2008. Reviewing meetings in teamspace. *Human—Computer Interaction* 23 (4): 406–32.

Lord, C., L. Ross, and M. R. Lepper. 1979. Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology* 37: 2098–109.

Madhavan, R., and R. Grover. 1998. From embedded knowledge to embodied knowledge: New product development as knowledge management. *Journal of Marketing* 62 (4): 1–12.

Marinova, D. 2004. Actualizing innovation effort: The impact of market knowledge diffusion in a dynamic system of competition. *Journal of Marketing* 68 (3): 1–20.

McNally, R. C., and J. B. Schmidt. 2011. From the special issue editors: An introduction to the special issue on decision making in new product development and innovation. *Journal of Product Innovation Management* 28 (September): 619–22.

Mittal, V., W. T. Ross, Jr., and M. Tsiros. 2002. The role of issue valence and issue capability in determining effort investment. *Journal of Marketing Research* 39 (4): 455–68.

Nenkov, G., J. Inman, J. Hulland, and M. Morrin. 2009. The impact of outcome elaboration on susceptibility to contextual and presentation biases. *Journal of Marketing Research* 46 (6): 764–76.

Nonaka, I., and H. Takeuchi. 1995. *The knowledge creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.

O'Reilly, C. A., III, D. F. Caldwell, and W. P. Barnett. 1989. Work group demography, social integration, and turnover. *Administrative Science Quarterly* 34 (1): 21–37.

Parks, C. D., and N. L. Nelson. 1999. Discussion and decision: The interrelationship between initial preference distribution and group discussion content. *Organizational Behavior and Human Decision Process* 80 (October): 87–101.

Riek, R. F. 2001. From experience: Capturing hard-won NPD lessons in checklists. *Journal of Product Innovation Management* 18 (5): 301–13.

Schmidt, J. B., and R. J. Calantone. 1998. Are really new product development projects harder to shut down? *Journal of Product Innovation Management* 15 (March): 111–23.

Schmidt, J. B., and R. J. Calantone. 2002. Escalation of commitment during new product development. *Journal of the Academy of Marketing Science* 30 (Spring): 103–18.

Schmidt, J. B., M. M. Montoya-Weiss, and A. P. Massey. 2001. NPD decision making effectiveness: A comparison of individuals, face-to-face groups, and dispersed groups. *Decision Sciences* 32 (Fall): 575–600.

Schmidt, J. B., K. Sarangee, and M. M. Montoya. 2009. Exploring new product development project review practices. *Journal of Product Innovation Management* 26 (September): 520–35.

Sethi, R., and Z. Iqbal. 2008. Stage-gate controls, learning failure, and adverse effect on novel new products. *Journal of Marketing* 72 (1): 118–34.

Slater, S. F., and J. C. Narver. 1995. Market orientation and the learning organization. *Journal of Marketing* 59 (3): 63–74.

Slotegraaf, R., and K. Atuahene-Gima. 2011. Product development team stability and new product advantage: The role of decision-making processes. *Journal of Marketing* 75 (1): 96–108.

Stasser, G. 1992. Pooling of unshared information during group discussion. In *Group process and productivity*, ed. S. Worchel, W. Wood, and J. A. Simpson, 48–57. Newbury Park, CA: Sage.

Stasser, G., and Z. Birchmeier. 2003. Group creativity and collective choice. In *Group creativity: Innovation through collaboration*, ed. P. B. Paulus and B. A. Nijstad, 85–109. New York: Oxford University Press.

Steinel, W., S. Utz, and L. Koning. 2010. The good, the bad and the ugly thing to do when sharing information: Revealing, concealing and lying depend on social motivation, distribution and importance of information. *Organizational Behavior and Human Decision Processes* 113 (2): 85–96.

Troy, L., T. Hirunyawipada, and A. Paswan. 2008. Cross-functional integration and new product success: An empirical investigation of the findings. *Journal of Marketing* 72 (6): 132–46.

Winquist, J. R., and J. R. Larson, Jr. 1998. Information pooling: When it impacts group decision making. *Journal of Personality and Social Psychology* 74 (2): 371–77.

Wittenbaum, G. M., A. P. Hubbell, and C. Zuckerman. 1999. Mutual enhancement: Toward an understanding of the collective preference for shared information. *Journal of Personality and Social Psychology* 77 (5): 967–78.

Wittenbaum, G. M., A. B. Hollingshead, and I. C. Botero. 2004. From cooperative to motivated information sharing in groups: Moving beyond the hidden profile paradigm. *Communication Monographs* 71: 286–310.

Appendix A. Exercise

You are a manager working in new product development for Magnar Inc. This company develops and sells technological components to automobile manufacturers. Magnar Inc. is well known for its products in the automobile industry. To compete in turbulent markets, it is very important that Magnar Inc. continually meet the needs of its customers (i.e., vehicle manufacturers) by providing desirable new products.

Magnar Inc.'s new product development process consists of three stages: idea screening, preliminary business analysis, and market testing (Figure A1). After EACH stage, there is a review point. New product projects must pass the review after each stage in order to reach the market place as final products. At the review point, a decision-making team, consisting of three managers,

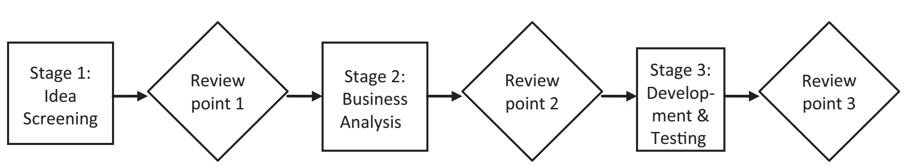

Figure A1. New Product Development Process

receives reports from the previous stage about the forecasted performance of the new product concepts that are being developed.

You and your teammates are the managers at **review point 3**, responsible for deciding whether or not to continue new product projects into actual new products according to the forecasted performance reports. For new product projects that your team decides to **continue**, you also have to decide how much to invest (within the budget assigned by the CEO) in order to continue developing the projects. The issue of how much to invest is very important because it will serve as the funding that supports subsequent product development activities. In other words, the new product performance is largely influenced by the allocated investment.

Your team has just received the performance forecast reports resulting from stage 3, market testing, of the product development process. The information about forecasted performance is listed in **Table A1**. As review point 3 is the final review point, your team has to evaluate the forecasted performance reports in **Table A1** on two potential new products: the *Vehicle Weight Sensor* and the *Driver Reflex Sensor* (see below for descriptions of both products). **All items of information in Table A1 are of equal importance for your evaluation.** That is, **you should consider them equally important in Table A1** (see below for definitions of each forecasted performance category).

Table A1. Information about Forecasted Performance

	New Product Projects	
Forecasted Performance	Vehicle Weight Sensor	Driver Reflex Sensor
Sales in unit*[1]	600,000	450,000
Revenue growth*[3]	12%	9%
Profits*[CI]	$1 million	$1.2 million
Return on investment (ROI)*[2]	13%	11%
Product cycle time[1]	9	6
Product innovativeness[2]	10	7
Product performance[CI]	6	9
Product quality[3]	9	6
Product advantage[CI]	7	10
Customer retention[CI]	6	9
Customer satisfaction[1]	10	7
Market share*[2]	17%	14%
Market size[CI]	7	10
Ease of manufacturing[3]	9	6

* These items of forecasted performance are absolute values; all others are 0-to-10 (higher is better).
[CI] = common information provided to all persons in the UID condition.
[1] = information provided only to person 1 in the UID condition.
[2] = information provided only to person 2 in the UID condition.
[3] = information provided only to person 3 in the UID condition.

In addition, due to a limited R&D budget, the CEO has determined that Magnar Inc. can only afford to continue one of the projects and so has instructed your team to **decide to continue one project** and to **terminate** the other, **according to the information reported in Table A1**. In other words, your team is tasked with selecting the superior new product project and eliminating the inferior project. You are also responsible for deciding how much of an investment (within the available budget) should be made into the new product project that your team decides to continue (do not allocate any funds to the terminated project). For example, there are two product concepts: X and Y. If you terminate product X, you will decide how much of the available budget to invest in product Y. Below, descriptions of the two new product projects are presented: the Vehicle Weight Sensor and the Driver Reflex Sensor, as well as definitions of each category of forecasted performance.

Vehicle Weight Sensor. This is a new vehicle weighing technology for speed and brake control. Sensors measure the weight of the vehicle (passenger, cargo, etc.), the condition of the vehicle's braking system, the proximity of other vehicles, as well as driving conditions to set the optimal acceleration rate and cruising speed for the vehicle to ensure that safe stopping distances are met. It is designed to enable drivers to better avoid accidents caused by sub-optimal braking performance under various conditions of vehicle weight.

Driver Reflex Sensor. This is a new system that evaluates a driver's reflexive reaction to road and driving conditions and adjusts vehicle performance according to driver response times. The vehicle's sensory system records driver acceleration rates, aggressiveness and responsiveness in relation to traffic levels and flow, as well as general driving conditions and engages the available driving aids like cruise control and ABS braking, as well as new steering aids to ensure a safe drive. This concept is seen as a potential reducer of impaired driving-related accidents.

Examples of Definitions (given to person 1 in the UID condition):

Sales in Units: The total number of units sold.
Profits: Net income after deducting costs and expenses in the first year when the new product is launched in the market.
Product Cycle time: Time frame of new product development—that is, whether or not the new product can be launched in the market on time.
Product Performance: To what extent the new product functions as expected.

Product Advantage: To what extent the new product excels in comparison to competitors' products.
Customer Retention: The extent to which the new product enables the company to maintain relationships with customers.
Customer Satisfaction: The extent to which the new product meets customer needs.
Market Size: The extent to which the new product covers target markets.

Appendix B. Study 2 Measures

Scale Item	UID-LC Reliability Index	UID-HC Reliability Index
Commitment		
1 = strongly disagree; 7 = strongly agree		
Our team is highly committed to the project of Vehicle Weight Sensor.	α = .74	α = .88
Our team would feel guilty if the project of Vehicle Weight Sensor was stopped.	CR = .84	CR = .93
Our team feels a sense of loyalty to the project of Vehicle Weight Sensor.	AVE = .65	AVE = .81
Cohesiveness		
How well did members in your team listen to each other?		
1 = not well at all; 5 = very well		
How well did members in your team get along?	α = .93	α = .86
1 = not well at all; 5 = very well	CR = .95	CR = .89
How well did members in your teamwork together?	AVE = .83	AVE = .68
1 = not well at all; 5 = very well		
I would gladly work with the other members of my team again.		
1 = strongly disagree; 5 = strongly agree		

α = Cronbach's alpha; CR = composite reliability; AVE = average variance extracted.