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The Effect of Reward Structures on the Performance of Cross-Functional Product Development Teams

This study examines the effect of reward structures on the performance of cross-functional product development teams. Results suggest that when it is easy to evaluate individual performances, position-based differential rewards lead to greater satisfaction. For long and complex projects, process-based rewards have a negative effect and outcome-based rewards have a positive effect on performance. For risky projects and highly competitive or relatively stable industries, a nonlinear and monotonically decreasing relationship exists between outcome-based rewards and product quality.

New product development (NPD) is critical for the renewal, survival, and success of organizations (Brown and Eisenhardt 1995; Wind and Mahajan 1997). To ensure success in the development of new products, marketing needs to have a significant influence; however, marketing often ends up playing a secondary role to engineering (Workman 1993). Greater coordination among functional areas is essential for successful NPD (Adler 1995; Olson, Walker, and Ruekert 1995; Wind and Mahajan 1997). Cross-functional teams have become an increasingly popular mechanism for achieving greater interfunctional integration and cooperation in the NPD process (Adler 1995; Griffin 1997; Olson, Walker, and Ruekert 1995; Pascarella 1997; Wind and Mahajan 1997).

Reward structures have been identified as one of the most important determinants of interfunctional integration among organizational employees and units (Coombs and Gomez-Mejia 1991). The use of rewards as a means of controlling, managing, and enhancing performance has been well established in marketing, especially in the areas of distribution channels (e.g., Gundlach and Cadotte 1994), sales force management (e.g., Ingram and Bellenger 1983), and organizational buying behavior (e.g., Anderson and Chambers 1985). In this article, we extend this line of inquiry to include another vital function of marketing—NPD.

We examine how reward structures affect the performance of cross-functional product development teams (CFPDTs). Performance of CFPDTs is measured in terms of speed to market, level of innovation, product quality, adherence to budget and schedule, and market performance (among others)—variables that have long been the focus of marketing literature (for some recent examples, see Olson, Walker, and Ruekert 1995; Workman 1993). In their introduction to *Journal of Marketing Research*'s *Special Issue on Innovation and New Products*, Wind and Mahajan (1997) identify speed to market, innovation, and product quality as among the most critical issues facing NPD in marketing. Our study draws attention to the unexplored area of reward structures, which can have a significant influence on these NPD outcomes.

Even small changes in the reward and evaluation structures of CFPDTs may lead to relatively large payoffs for NPD performance (Feldman 1996). Despite its obvious potential impact, examination of this topic by either academic researchers or organizations remains sparse (Griffin 1997). As such, an examination of the effect of reward structures on CFPDT performance presents an intriguing problem from both theoretical and managerial perspectives.

Organizational reward and evaluation structures have not kept pace with the changes in the work environment (Wallace 1987). Robbins and Finley (1995) contend that outdated reward structures are a common reason teams fail in organizations. They note that rewards and evaluations are still functionally determined: Teams and individual members are often rewarded for the wrong things. Many articles in the popular business press have also commented on the pervasiveness and complexity of this problem:

> Building cross-functional teams can work wonders in developing new products, but only if people are rewarded as members of a team.... That's one reason why most teams fail to produce. (*BusinessWeek* 1995, p. 154)

> [In order to succeed in streamlining and flattening their structure,] organizations must change the appraisal and pay systems to reward team results, not just individual performance. (Byrne 1993, p. 78)

> When it comes to paying teams, managers still throw up their hand-held computers in despair. Pay the team as a group? Then won't your star performers feel slighted? Pay for individual performance? What does that do to encourage teamwork? (Dumaine 1994, p. 87)

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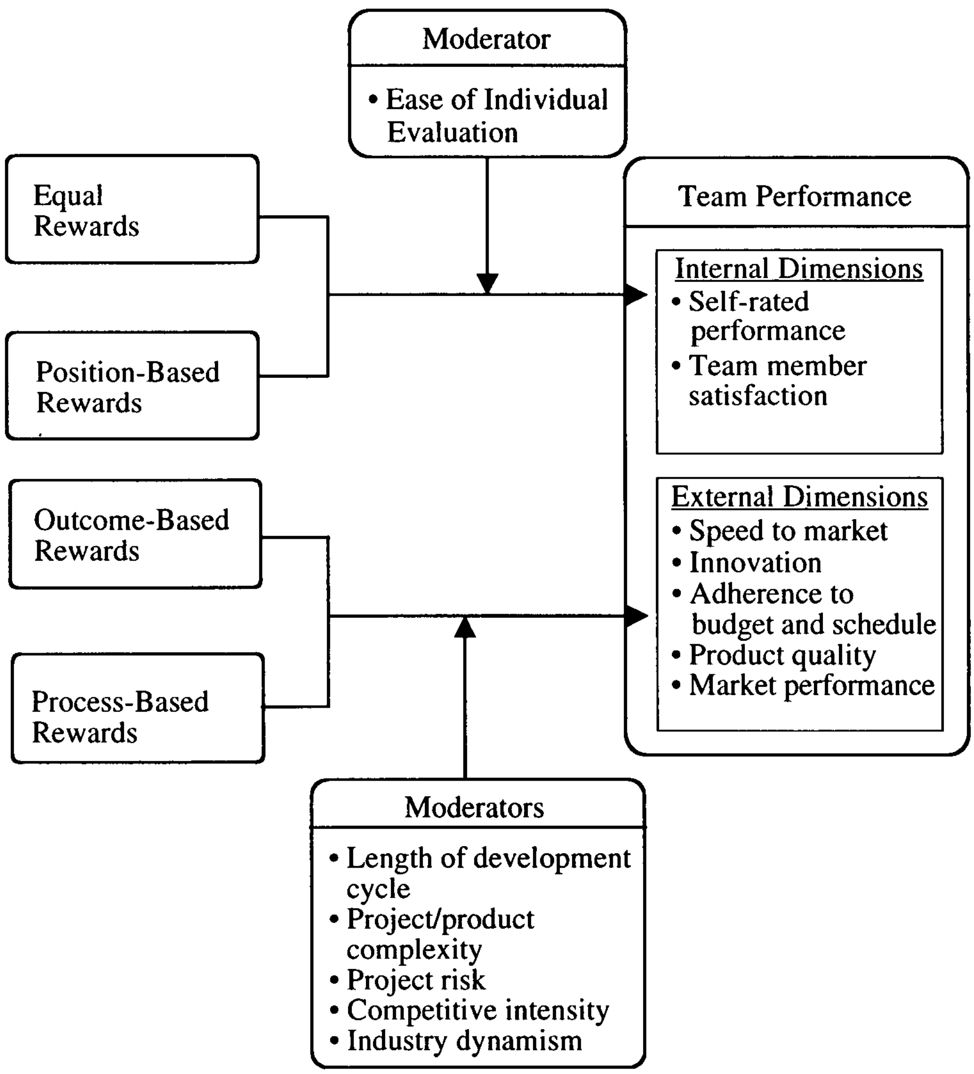
Pascarella (1997) notes that two major questions confront organizations that actively use CFPDTs: *how* and *when* to reward such teams. Field interviews conducted during this study confirm that managers struggle with two issues pertaining to CFPDT rewards: how to distribute rewards among team members and on what criteria the team rewards should be based. Rewards can be distributed among team members equally or on the basis of the position/status enjoyed by the individual members in the organization. Similarly, teams can be rewarded on the basis of the outcome produced by them or for adhering to a certain process.

Existing literature suggests that instead of representing end points of two continuums, equal/position-based rewards and process-/outcome-based rewards constitute four distinct constructs (e.g., Jaworski 1988; Steers and Porter 1991). In this exploratory study, we examine the effect of these four reward structures on the performance of CFPDTs and propose a midrange theory in a new domain. To our knowledge, this is one of the first studies that uses industry data to examine empirically the effect of reward structures on CFPDT performance. Team performance is measured along multiple dimensions that vary from speed to market to team member satisfaction (broadly classified as internal and external team performance dimensions). In Figure 1, we outline the conceptual framework developed and tested in this study. This framework addresses the following research questions:

1. How are the internal performance dimensions of CFPDTs (i.e., team member satisfaction and self-rated performance) affected by equal and position-based distribution of rewards among team members? Under what conditions should rewards be distributed equally among the team members? When should rewards be distributed on the basis of the position/status of the team member in the organization?
2. How are the external performance dimensions of CFPDTs (i.e., speed to market, level of innovation, adherence to budget and schedule, product quality, and market performance) affected by rewards that are linked to the NPD process versus the outcome produced by the team? Under what conditions should team rewards be linked to the outcome as opposed to the process of product development?

FIGURE 1
The Effect of Equal/Position Rewards and Outcome-/Process-Based Rewards on Team Performance



Conceptual Development and Hypotheses

Reviews of both academic and popular business literature reveal little to guide managerial decision making on rewarding CFPDTs. Some researchers (e.g., Deschamps and Nayak 1995; Parker 1994; Robbins and Finley 1995) have alluded to the topic; however, their treatment is based more on experience and case studies than on empirical data. Other studies (e.g., Gladstein 1984; Thamhain 1990; Wageman 1995) have addressed group rewards tangentially. Although some recent attempts (Faure and Weitz 1993; Walker, Ruekert, and Olson 1992) directly address this issue, the literature still lacks a comprehensive examination of team rewards (Griffin 1997; Olson, Walker, and Ruekert 1995).

A lack of theory in the area of team rewards is further complicated by our observations that no mechanisms of rewarding CFPDTs appear to be consistently effective in the field. Furthermore, little empirical data are available to support the strategies recommended in the popular business press. In the absence of a well-defined stream of research on a topic, a qualitative, practitioner-oriented approach to theory development is recommended (Kohli and Jaworski 1990; Zaltman, LeMasters, and Heffring 1982). Therefore, we conducted extensive qualitative interviews to develop the conceptual framework presented in Figure 1.

Over 18 months, qualitative data were collected in 37 interviews with 57 individuals. These individuals were drawn from a cross-section of functional backgrounds and hierarchical levels and were involved in the NPD process. They included representatives from 26 different CFPDTs and executives involved in product development at nine medium-sized to large organizations. The data collected during this phase were used to establish the external validity of the conceptual framework, generate preliminary hypotheses and scale items, and pretest the survey instrument used during the second phase of data collection.

Initial field interviews indicated that the reward and evaluations structures that resulted in positive outcomes in one team had a negative effect on others, suggesting the influence of contextual variables. Although discerning patterns proved difficult, three consistencies emerged from our interviews:

- *When* teams are rewarded, that is, the timing of rewards, had a significant impact on team performance (i.e., process- and outcome-based rewards).
- Team performance was also affected by *how* the rewards were distributed among the members of the team (i.e., equal and position-based rewards).
- The effects of these reward structures were contextual and depended on the characteristics of the project and industry under consideration.

The moderating influence of some project- and industry-specific variables, such as project/product complexity and industry dynamism, was suggested by previous studies as well (e.g., Gladstein 1984; Pascarella 1997). We incorporated these qualitative data into the conceptual framework before commencing the second phase of data collection using a survey instrument.

Team Performance

Performance of CFPDT is a multidimensional construct. It implies different things to different people under different contexts. Shea and Guzzo (1987) suggest that multiple measures should be used to evaluate team performance. In this study, the performance of CFPDTs is disaggregated and measured along seven underlying dimensions, broadly classified along external and internal criteria. External performance criteria are largely market based, and internal criteria are more pertinent to the team/organization.

Five external performance dimensions were considered, three of which were previously identified in the literature: (1) speed to market, a relative measure of time taken to launch a product; (2) adherence to budget and schedule; and (3) level of innovation, the degree of newness of the product (Ancona and Caldwell 1991, 1992a; Olson, Walker, and Ruekert 1995; Walker, Ruekert, and Olson 1992). Our interviews, as well as recent studies, suggested the inclusion of two additional external performance dimensions: (4) product quality, measured in terms of customer satisfaction, product reliability, number of product-related complaints, and warranty and repair costs (Meyer 1994; Olson, Walker, and Ruekert 1995); and (5) market performance, postintroduction performance of the product relative to expectation and competition (Meyer 1994).

Teams were also evaluated along two internal performance dimensions: (1) self-rated team performance, a measure of the team's performance compared with other NPD teams in the organization (Ancona and Caldwell 1991, 1992a); and team member satisfaction, the degree to which association with the team is considered a worthwhile, productive, and satisfying experience by team members (Meyer 1994; Pinto, Pinto, and Prescott 1993; Warr, Cook, and Wall 1979). The distribution of rewards is expected to influence the internal dimensions of team performance significantly, and the basis on which teams are rewarded is expected to be more germane to the external dimensions of team performance.

Relationship Between Equal and Position-Based Rewards and Internal Dimensions of Team Performance

Deutsch (1968) examines cooperation and competition in workgroups and suggests that in cooperative situations members enjoy relatively equal standing with respect to an outcome/objective, whereas in competitive situations their standing may be different. On the basis of this argument, two dimensions of reward structure were identified as they related to the distribution of rewards among the team members: *Equal rewards* are defined as the degree to which rewards are distributed evenly among team members, and *position-based rewards* are defined as the degree to which rewards are distributed among team members on the basis of their position/status in the organization.

Some researchers argue that team members should be rewarded as a unit because differential rewards are inherently inconsistent with the team concept (*BusinessWeek* 1995, p. 154; Parker 1994). Others suggest that the decision whether to reward team members equally or differentially should be based on the degree to which the team members are dependent on one another for the performance of their tasks (Deutsch 1968; Faure and Weitz 1993; Wageman 1995). The general consensus among these researchers is that equal rewards are more appropriate when the level of task interdependence is high. However, our field interviews suggested that it is not task interdependence per se but the ease with which individual performance can be identified and evaluated that should determine the manner of reward distribution. Implicit in the task interdependence argument is the assumption that individual contributions will be difficult to evaluate in highly interdependent tasks.

Consistent with the observation of some researchers (e.g., Parker 1994; Pascarella 1997), our interviews indicated that even in highly interdependent NPD projects, the efforts, responsibilities, or contributions of one or more members stood out. When interviewed alongside other team members, these star performers expressed no desire for extra recognition or rewards. However, when interviewed separately, they expressed a yearning for some extra recognition or reward that acknowledged their above-average contributions. Such conflicting feedback suggested that the issue of differential versus equal reward distribution was a complex one, in which true desires may be concealed because of peer pressure to be perceived as a team player.

Desire for personal recognition is consistent with individualism, a fundamentally Western/U.S. cultural value (Nahavandi and Aranda 1994). Qualitative data indicate that in an inherently collective (team) situation, this tendency, though suppressed, still persists. Harder (1992) discovered that underrewarding can lead to selfish and less-cooperative behavior in an interdependent group with a common goal. Therefore, when contributions are obvious or easy to evaluate, organizations may be well advised to recognize extraordinary individual effort, or they will risk losing their star performers (Zenger 1992).

However, contributions to the team should not be determined on the basis of effort alone. Even though members of a CFPDT have joint responsibility and joint accountability, the responsibility and risk shared by different members are not always equal. The amount of risk and responsibility shouldered by each member depends on his or her seniority, position in the organization, and role on the team. Wallace (1988) argues that the distribution of rewards should be structured to reflect the different levels of risk and responsibility assumed by each member. We consider contributions to the team to include the effort, risk, and responsibility assumed by each team member.

The need to reward individuals differentially in a group/team setting can also be argued from organizational justice and fairness perspectives. Distributive justice relates to individuals' perception of whether they are receiving a fair share of the available rewards—proportionately to their contribution to the group (Baron and Byrne 1997). Equity theory pertains to fairness in social exchanges and distributive justice, whereby individuals compare the ratio of their own rewards and contributions (to a group) to those of other individuals in the group (Adams 1965; Greenberg 1993).

Cropanzano and Randall (1993) note that perceptions of injustice (rewards being low in proportion to an individual's contribution) or inequity (in the distribution of rewards among individuals) can result in dissatisfaction, lower motivation, and even dysfunctional behavior. They suggest that equity and distributive justice should be taken into consideration, especially when dealing with people from individualistic cultures or when the emphasis is on maximizing group performance. Parker (1994, p. 134) summarized this argument as follows:

> [In addition to bringing the rewards down to the team level,] we still need to recognize team members who are outstanding team players—people who go beyond what is required and those who make an outstanding individual contribution to a team.

Many researchers have criticized the notion that team members need to be individually (differentially) recognized and rewarded, as doing so would be inconsistent with a team-based approach. Donnellon and Scully (1994) argue that differential rewards or individual recognition takes too narrow and dim a view of human nature. Furthermore, unequal reward distribution under interdependent conditions may undermine cooperation and increase competition within the team, lowering overall group productivity (Baron and Cook 1992; Deutsch 1968). This line of reasoning notwithstanding, support in favor of individual recognition in addition to team rewards remains strong (e.g., Deschamps and Nayak 1995; Parker 1994; Pascarella 1997; Robbins and Finley 1995).

Conflicting evidence presented by both qualitative field interviews and relevant theories compels us to examine competing viewpoints. Therefore, we propose and test alternative hypotheses in this study with the intention of reducing the contradictions in the literature. The discussion so far suggests that position-based differential rewards could be used when outstanding individual contribution is apparent to most members of the team (Pascarella 1997). This leads us to propose the following set of alternative hypotheses:

> H_1: When the ease of individual evaluation is high, a position-based reward structure will be positively related to internal dimensions of CFPDT performance.
>
> $H_{1(alt)}$: When the ease of individual evaluation is high, a position-based reward structure will be negatively related to internal dimensions of CFPDT performance.

When the cost and effort required to monitor individual contributions in a team is high, organizations are likely to share rewards (Alchian and Demsetz 1972). Therefore, when evaluating individual performance in a group setting is difficult, an equal reward structure is expected to be more effective. Procedural justice suggests that people are also sensitive to the fairness of the procedures used to distribute rewards among group members (Cropanzano and Randall 1993). People make a clear distinction between equity (the perception that the members' rewards are proportional to their contribution to the group) and procedural justice (the perception that fair and just procedures are followed to distribute rewards within a group) (Baron and Byrne 1997). Any perception of unfairness in the procedure can affect people's satisfaction with the rewards (Cropanzano and Randall 1993). Baker, Jensen, and Murphy (1988, p. 608) note that "Biased and inaccurate performance evaluation reduces productivity by reducing the effectiveness of incentives in organizations."

Therefore, when the ease of individual evaluation is low, a perception of unfairness may persist in the distribution of rewards. Such a perception may be hard to dislodge and could lead to dissatisfaction and lower morale and performance, regardless of how the rewards are distributed within the team (Cropanzano and Randall 1993). Therefore, we propose the following set of alternative hypotheses:

H_2: When the ease of individual evaluation is low, an equal reward structure will be positively related to internal dimensions of CFPDT performance.

$H_{2(alt)}$: When the ease of individual evaluation is low, an equal reward structure will be negatively related to internal dimensions of CFPDT performance.

Relationship Between Process- and Outcome-Based Rewards and External Dimensions of Team Performance

The dimensions of process- and outcome-based rewards are derived from the organizational control literature, which describes control as a process of monitoring and evaluating behaviors and outcomes (Eisenhardt 1985; Ouchi and Maguire 1975). Rewards and punishments are logical extensions of the control process, following monitoring and evaluation. Jaworski (1988) identifies several types of formal and informal controls. Two formal control mechanisms, process and outcome controls, are considered relevant to this study. Process controls are exercised *during* the execution of a task; output controls are exercised *after* a task is completed. Analogous to these two kinds of controls, *process-based rewards* are defined as the degree to which team rewards are tied to procedures, behaviors, or other means of achieving desired outcomes (i.e., completion of certain phases in the development process) (Deschamps and Nayak 1995). *Outcome-based rewards* are defined as the degree to which team rewards are tied to the bottom-line profitability of the project.

Although the relationship between organizational control and overall team performance has been examined (Henderson and Lee 1992; Walker, Ruekert, and Olson 1992), little is known about (1) how external dimensions of team performance are affected by linking team rewards to either process- or outcome-based measures and (2) how various product and industry characteristics affect the relationship between external dimensions of team performance and process-/outcome-based rewards. Process- and outcome-based controls can be used simultaneously (Merchant 1985), and researchers have argued that each can positively affect team performance (Henderson and Lee 1992; Walker, Ruekert, and Olson 1992). Our field interviews suggest that the effect of process- and outcome-based rewards is more complicated than anticipated. Process- and outcome-based rewards appear to have opposite effects, and their effect on performance is moderated by several factors.

For products with long development cycles, the team must stay motivated over the course of the development process. Such teams have a greater probability of turnover in their membership. During interviews, members of these teams reported less tolerance for delaying gratification (rewards) until the market performance of the product was evident. Under such conditions, output controls may be ineffective or even counterproductive (Hopwood 1972). Consistent with Parker's (1994) work, our qualitative data suggest that for long projects a process-based reward system focused on meeting procedural milestones (such as completion of specific phases) may be more effective.

However, the organizational control literature associates several potential disadvantages with process-based criteria for evaluating performance. Process-based criteria could make people dependent on the process itself, thus making them inert and resistant to change (Merchant 1985). Emphasizing process over outcome could promote risk-averse behavior (Cardinal 1990) and lower motivation and satisfaction (Hackman and Oldham 1976). This discussion suggests the following alternative hypotheses:

H_3: For products with long development cycles, a process-based reward system will be positively related to external dimensions of CFPDT performance.

$H_{3(alt)}$: For products with long development cycles, a process-based reward system will be negatively related to external dimensions of CFPDT performance.

Similarly, organizations may need to exercise greater control over planning, monitoring, and scheduling the development of complex products (Benghozi 1990). This is more easily achieved if the reward and control mechanisms are linked to process-based measures, because doing so ensures that minimum acceptable standards of quality are met and satisfied. Process-based controls and rewards help ensure predictability in behaviors, activities, and procedures deemed critical to success (Cardinal 1990). However, process-based control structures also restrict opportunities for achievement by discouraging creativity, innovation, and flexibility (Merchant 1985). Therefore, process-based rewards are expected to encourage team members to focus on the procedures required to produce the desired outcome rather than on the outcome itself. In such a situation, teams are likely to have a much lower stake in the success of the product, and most of the risk associated with developing the product is transferred to the organization. This discussion suggests the following alternative hypotheses:

H_4: For highly complex products, a process-based reward system will be positively related to external dimensions of CFPDT performance.

$H_{4(alt)}$: For highly complex products, a process-based reward system will be negatively related to external dimensions of CFPDT performance.

As a semiautonomous unit, the team acts as an agent of the organization with a mandate to develop a particular product. As such, agency theory (Bergen, Dutta, and Walker 1992; Eisenhardt 1985, 1989) can be used to design suitable reward structures for CFPDTs, as has been done for other professionals employed by organizations (Bloom and Milkovitch 1998). Agency theory makes the fundamental assumptions that both the agent and the principal are rational and self-interested and the agent is both effort- and risk-averse (Bloom and Milkovitch 1998). This creates a moral hazard, in which the agent (CFPDT) tends to maximize its compensation without exerting the effort required to maximize the principal's (organization's) goals (Baiman 1990; Bergen, Dutta, and Walker 1992; Bloom and Milkovitch 1998; Eisenhardt 1989).

Consequently, when dealing with agents, organizations prefer outcome-based reward and evaluation criteria, because they minimize the organization's risk by ensuring that the desired output is obtained (Eisenhardt 1989).

Agents, in contrast, prefer process-based reward and evaluation criteria, because this minimizes the agent's risk by ensuring it of compensation regardless of the project outcome. Baiman (1990) suggests that organizations should balance their use of outcome-based rewards so that the rewards motivate the agents to act in the organization's best interest.

Bloom and Milkovitch (1998) posit that such a balance addresses the inherent conflict of interest between the agent and the organization and is likely to result in an optimal reward structure as long as an undue amount of risk is not passed on to either party. They further note that though classical agency theory places equal emphasis on both the risk- and effort-averse nature of the agent, much prior research has overlooked risk considerations, concentrating mainly on the effort aversiveness of the agent. Consideration of risk is an essential element in the selection of an appropriate reward structure, because risk and reward jointly affect performance. Therefore, balancing incentives and risk sharing may be essential in designing reward structures for achieving optimal performance (Bloom and Milkovitch 1998; Eisenhardt 1989).

Risk has been defined in terms of uncertainty about future events/outcomes and the magnitude of failure (March and Shapira 1987). For CFPDTs, risk can arise from the nature of the project itself (i.e., product/project risk) or from the larger environmental conditions existing in the industry (i.e., industry dynamism and competitive intensity). When dealing with risky products or highly dynamic industries, CFPDTs face considerable uncertainty about future outcomes. For teams in highly competitive and dynamic industries, the cost of failure is very high. Under each of these conditions, both the organization (principal) and the team (agent) tend to minimize their own risks. Sharing risk provides an optimal way to maintain autonomy and accountability without sacrificing objectives of either the team or the organization. A purely outcome-based reward structure is likely to be counterproductive in these cases, because it places an excessive amount of risk on the CFPDT. In contrast, disconnecting the rewards from project outcomes not only forces the organization to absorb a disproportionate amount of the risk but also fails to motivate the team.

When environmental, technological, or organizational factors obscure the measurement of output or hinder output performance, purely output-based controls can be ineffective (Hopwood 1972). Similar impediments and ambiguities are likely when the industry is highly competitive or turbulent. Agency theory suggests that under such conditions, linking reward structure to the outcomes to a moderate degree should distribute the risk evenly between the team and the organization, resulting in an optimal (most effective) contract. For risky products, or when teams are operating in highly competitive or dynamic industries, an inverted-U–shaped relationship is likely to exist between outcome-based rewards and the external team performance dimensions. Performance is expected to be highest for moderate levels of outcome-based reward structures and is likely to suffer if rewards are completely dependent on or independent of the outcomes. Therefore, we hypothesize the following:

H_5: For highly risky products, an inverted-U–shaped relationship exists between outcome-based rewards and external dimensions of CFPDT performance.

H_6: For highly competitive industries, an inverted-U–shaped relationship exists between outcome-based rewards and external dimensions of CFPDT performance.

H_7: For highly dynamic industries, an inverted-U–shaped relationship exists between outcome-based rewards and external dimensions of CFPDT performance.

Methodology

Study Context and Sample Selection

High-tech industries were chosen as the context for this research study because of their extensive experience in using cross-functional teams in the NPD process (e.g., Ancona and Caldwell 1992a, b; Henderson and Lee 1992). Several *Fortune*-1000 and medium-sized companies (annual revenues ranging from $100 million to $1 billion) were invited to participate in this study through personal contacts and executive and faculty referrals. Nine of these organizations agreed to participate in Phase 1 of the study, which involved in-depth interviews with team members and managers. In Phase 2 of the study, a survey instrument was administered to a larger sample comprising respondents from six organizations. Four of these six organizations were drawn from the original nine organizations that participated in Phase 1. Five organizations dropped out of the study after Phase 1 of data collection, citing the sensitive nature of the information sought or a lack of time.

Three criteria were used to screen teams for both the interviews and the survey:

1. The team should be strictly intraorganizational.
2. The product being developed by the team should be intended for the open (competitive) market.
3. Teams should have either introduced their product within the past 12 months or have an ongoing project at an advanced stage of development.

The first criterion was needed to avoid contamination of the data due to spurious variance caused by interorganizational factors. The second criterion was adopted because market performance would be irrelevant for products destined for in-house use. Third, products older than one year were excluded to avoid problems with recall and take into account the typically high turnover in high-tech organizations. Each organization was asked to provide teams that varied along the following product-market dimensions: level of competitive intensity, level of product innovation, project risk, duration of product development cycle, and degree of success of the product.

Measure Development and Pretesting

Wherever possible, established scales were used to measure the constructs in this study. However, for some constructs (e.g., process- and outcome-based rewards), new measures were adapted from existing scales. For others (e.g., product quality), field interviews were used to generate a pool of items, which was then used to develop new scales. The measures were pretested in three stages. First, we presented the survey instrument to four doctoral students who were trained in psychometric theory and experienced in survey development. They were asked to fill out the preliminary survey instrument and identify any ambiguous or irrelevant items. These items were dropped or modified in the second draft of the questionnaire.

In the second stage, we solicited feedback from six academic experts. All constructs were clearly defined and their item measures identified, so that the experts could critically evaluate the scale items and their ordering. They were also asked to identify items that failed to capture the construct and to suggest additional items that would capture the entire construct domain. Third, we administered the resulting draft to 16 members representing three teams from two separate organizations. In face-to-face interviews, they were asked to point out items or instructions they found confusing, irrelevant, or repetitive.

Data Collection

Data were collected in two phases: qualitative field interviews and survey administration. As discussed previously, the purpose of the initial qualitative interviews with 57 members of 26 teams was to refine the theoretical framework and develop the survey instrument. Next, a survey was administered to a larger sample of CFPDT members, and the resulting data were used to test our hypotheses empirically. Survey data were collected from 246 members of 65 teams, drawn from 13 divisions of 6 medium-sized to large organizations. The teams varied in size from 3 to 22 members, with an average of 7.8. By definition, these teams were temporary, having worked together for anywhere from 3 to 72 months.

Respondents were instructed to return the completed questionnaires directly to the researcher or to a key liaison in each organization. Instead of being distributed through a mass mailing, questionnaires were distributed to one or two organizations at a time to ensure a high response rate. Multiple respondents were requested on each team for a cross-section of opinion (Ancona and Caldwell 1992a; Henderson and Lee 1992; Olson, Walker, and Ruekert 1995). Each team leader was asked to forward the questionnaire to at least three members of the core team. For smaller teams, responses from a single key member were considered acceptable. The number of informants from each team varied from 1 to 13, with an average of 3.7. Respondents were asked to identify their functional backgrounds and status (i.e., team leader or member). Responses from team members who represented different functional areas and hierarchical levels were obtained.

Data from multiple (key) respondents on the same team were pooled and averaged to obtain an aggregate (team-level) response (Ancona and Caldwell 1992a; Olson, Walker, and Ruekert 1995). This method was preferred to using responses from all team members, because some teams had 20 or more members. Such an approach is consistent with that of Henderson and Lee (1992), who demonstrated the utility of administering surveys to multiple key respondents on each team. The level of convergence among the multiple respondents appears in Appendix A, which presents the low, high, and average standard deviations on each construct across the teams in the sample.

Scale Refinement

The reliability and validity of the measures in this study were established according to standard procedures recommended by Gerbing and Anderson (1988). First, we performed an exploratory factor analysis on each construct to investigate its unidimensionality and underlying factor structure. Items with significant cross-loadings (i.e., >.35) were deleted from the analysis until a single-factor solution was obtained. Exploratory factor analysis was also used to verify whether the reward structures examined in this study constituted opposite ends of two continuums or four distinct constructs. We present the results of this principal component analysis in Appendix B. A stable four-factor solution was obtained where factors corresponded to each of the rewards constructs used in the study.

Second, we used confirmatory factor analysis to establish the psychometric properties of the scales used to measure the constructs. The size of our sample (n = 65) precluded the use of confirmatory factor analysis on aggregate-level data (Anderson and Gerbing 1995; Hu and Bentler 1995). Therefore, we disaggregated data to the individual level to perform the confirmatory factor analyses.[1] We used procedures outlined by Venkatraman (1989) to establish the unidimensionality and convergent and discriminant validity of the constructs as well as the validity of the nomological network. All constructs either met or exceeded the recommended criteria deemed acceptable for the establishment of these psychometric properties. In two cases of convergent validity, adherence to budget and schedule and product quality, the Bentler–Bonett Index values (Δ) of .89 were below the recommended level of .90. However, we considered these values acceptable because they were close to the recommended threshold (Venkatraman 1989).

A more encompassing and rigorous "all item–all construct" test of discriminant validity was also conducted using LISREL. A process analogous to the Lagrange-Multiplier test in EQS was followed (Schumacker and Lomax 1996). This test examined all underlying relationships between the 82 exogenous items measuring 16 endogenous constructs in the study.[2] Project length was excluded from this analysis because it was measured using a single objective item. The results of this test largely supported the discriminant validity of our measures. The modification indices show that of the 1230 nonhypothesized paths between the exogenous items and the endogenous constructs, 291 paths had chi-square values greater than 3.84 (degrees of freedom = 1, $\alpha < .05$). At a 95% confidence level, 62 of these paths would likely be significant by chance alone. Schumacker and Lomax (1996) note that this method may cause meaningless parameters to be included in a subsequent model; therefore, any interpretation of the modification indices should be guided by theoretical rationale. They recommend that these indices should be used as potential indicators of misfits rather than givens for respecifying a model.

Most substantial modification indices were seen between the items measuring different performance variables and the endogenous performance constructs (i.e., product quality and innovation and self-rated performance/adherence to budget and schedule and team member satis-

[1]We are grateful to one of the anonymous reviewers for this suggestion.

[2]We are grateful to one of the anonymous reviewers for this suggestion.

faction). These results suggest that the performance dimensions may not be orthogonal and may have interrelationships that could be explored in future studies. Modification indices for items measuring project risk and complexity with endogenous performance constructs (i.e., product quality and innovation) suggest that these moderator variables may be quasi moderators as opposed to pure moderators (Sharma, Durand, and Gur-Arie 1981).

Finally, to establish the internal consistency of the measures, we computed Cronbach's alpha coefficients to estimate the reliability of each scale. We dropped items with low item-to-total correlation from the analysis. Operational definitions of the constructs, along with the items used to measure them and the reliability coefficient of each scale, are presented in Appendix C. Nearly all scales display high internal consistency and exceed the .70 level of acceptability laid down by Nunnally (1978). At .68, .63, and .69, respectively, the scales for process- and outcome-based rewards and equal rewards are only slightly below Nunnally's criterion.

Model Estimation

Because some of the hypothesized relationships are nonlinear, both linear and nonlinear regression analyses were used to examine the effect of reward structures (independent variables) on various dimensions of team performance (dependent variables). A separate regression model was analyzed for each dimension of team performance shown in Figure 1. The sign and significance of the standardized coefficients associated with each independent variable provide a test of our hypotheses. Wherever alternative hypotheses were specified, two-tailed t-test results are considered.

We hypothesized that several industry- and project-specific variables will moderate the relationship between team rewards and performance. These effects are estimated by dividing the sample along the mean into two subgroups of high and low levels of the moderator variable. Separate regression analyses were conducted on each subgroup to test the specific hypothesis (Sharma, Durand, and Gur-Arie 1981). Chow's (1960) F-test is performed in each case to determine whether the difference between the high and low subgroups is statistically significant.

H_5 through H_7 predict a nonlinear (inverted-U–shaped) relationship between the independent and dependent variables. This relationship is tested for each relevant subgroup by regressing the dependent variable (Y) on the linear (X) and square term (X^2) of the independent variable simultaneously. An inverted-U–shaped relationship is supported if the coefficient of the X term is positive and the coefficient of the square term (X^2) is negative (Aiken and West 1991, pp. 65–66). Chow's F-test is then performed to determine whether the difference between the high and low subgroups is statistically significant.

Results

Relationship Between Equal and Position-Based Rewards and Internal Dimensions of Team Performance

H_1 predicts that when ease of individual evaluation is high, position-based rewards will be positively related to the internal dimensions of team performance. To test this hypothesis, we split the sample into high and low ease of individual evaluation subgroups for both team member satisfaction and self-rated performance. Regression results presented in Table 1 show that position-based rewards have a significant, positive association with team member satisfaction ($\beta = .35$, $p = .05$) for teams in which the ease of individual evaluation was high. No such relationship was found for the low ease of individual evaluation subgroup. Chow's F-test showed that the difference between the two subgroups is statistically significant ($F_{2, 49} = 3.23$, $p < .05$). We conducted a similar analysis for the relationship between position-based rewards and self-rated performance, which was not significant. Therefore, H_1 is partially supported.

H_2 posits that when ease of individual evaluation is low, equal rewards will be positively related to internal dimensions of team performance. The alternative hypothesis suggests that this relationship will be negative. Table 1 shows

TABLE 1
Effect of Equal and Position-Based Rewards on the Internal Dimensions of Team Performance: Regression Results for Total and Subgroup Samples Based on High and Low Ease of Individual Evaluation

	Internal Dimensions of Team Performance					
	Team/Member Satisfaction			Self-Rated Performance		
Reward Structures	Total	High	Low	Total	High	Low
Position-based rewards	.17	.35**	–.11	.02	.17	–.34*
R^2	.03	**.12****	**.01**	.00	.03	.12*
Equal rewards	–.05	.14	–.36*	–.09	.06	–.47***
R^2	.00	**.02**	**.13***	.00	**.00**	**.22*****

*p < .10.
**p < .05.
***p < .01.
Notes: n (total) = 53, n (high) = 29, n (low) = 24. The high and low subgroups for which the Chow test indicates a statistically significant difference are presented in bold.

that when ease of individual evaluation is low, equal rewards are negatively related to both team member satisfaction (β = –.36, p = .08) and self-rated performance (β = –.47, p = .01). The difference between the high and low ease of individual evaluation subgroups was significant for both team member satisfaction ($F_{2, 49}$ = 3.24, p < .05) and self-rated performance ($F_{2, 49}$ = 3.33, p < .05). These results support $H_{2(alt)}$.

Relationship Between Process- and Outcome-Based Rewards and External Dimensions of Team Performance

H_3 predicts that for long product development cycles, a process-based reward structure will be positively related to the external dimensions of team performance, whereas $H_{3(alt)}$ suggests that this relationship will be negative. The sample was split into two subgroups of long or short product development cycles. The team performance dimensions were regressed on process-based rewards for each subgroup. Table 2, Part A, shows that for long development cycles, process-based rewards had a stronger negative relationship to speed to market (β = –.48, p = .01), adherence to budget and schedule (β = –.57, p = .003), product quality (β = –.51, p = .01), and market performance (β = –.53, p = .007) than did shorter projects. Chow's F-test showed significant differences between the long and short development cycle subgroups in each case. These results support $H_{3(alt)}$.

In further analysis, we examined how the length of the development cycle moderated the relationship between outcome-based rewards and team performance. Table 2, Part A, shows that for long development cycles, outcome-based rewards have a marginally significant, positive relationship with speed to market (β = .36, p = .08), innovation (β = .36, p = .08), and product quality (β = .38, p = .07) and a significant, positive relationship with market performance (β = .46, p = .02). Differences between the subgroups were significant for speed to market ($F_{2, 49}$ = 4.29, p < .025), innovation ($F_{2, 49}$ = 3.30, p < .05), and market performance ($F_{2, 49}$ = 3.25, p < .05). We did not find any difference between the long and short product development cycle subgroups; however, for the total sample, product quality (β = .34, p = .01) showed a significant, positive relationship with outcome-based rewards. These results are consistent with our previous argument that process- and outcome-based rewards have opposite effects on team performance.

H_4 explores the moderating effect of project complexity on the relationship between process-based rewards and the external dimensions of team performance. Table 2, Part B, shows that for the high-complexity subgroup, process-based rewards have a significant, negative association with speed to market (β = –.36, p = .04) and a marginally significant, negative association with product quality (β = –.29, p = .09). The negative relationship between process-based rewards and product quality was stronger for low-complexity products (β = –.48, p < .05) than high-complexity products. Chow's F-test showed a significant difference between the high- and low-complexity subgroups for both speed to market ($F_{2, 49}$ = 3.26, p < .05) and product quality ($F_{2, 49}$ = 3.48, p < .05), in partial support of $H_{4(alt)}$. Additional analysis examined whether outcome-based rewards had an effect opposite to that of process-based rewards when product complexity moderated the relationship. Table 2, Part B, shows that for the low-complexity subgroup, outcome-based rewards were positively associated with speed to market (β = .42, p = .05), product quality (β = .36, p = .09), and market performance (β = .52, p = .01). However, Chow's F-test was significant only for speed to market ($F_{2, 49}$ = 3.86, p < .05).

H_5 predicts that for high-risk products, an inverted-U–shaped relationship will exist between outcome-based rewards and the external dimensions of team performance. Such a relationship was found to exist only for product quality (see Table 3). For the high-risk subgroup, outcome-based rewards were positively related (b = 3.67, p = .01), and the square term of outcome-based rewards was negatively related (b = –3.29, p = .02) to product quality. Chow's F-test shows that the difference between the high- and low-risk subgroups is significant ($F_{3, 47}$ = 4.23, p < .025).

We also hypothesized that an inverted-U–shaped relationship will exist between outcome-based rewards and external performance dimensions for highly competitive (H_6) and dynamic (H_7) industries. As before, a significant relationship was found to exist only between outcome-based rewards and product quality (see Table 3). For highly competitive industries, outcome-based rewards were positively related (b = 2.94, p = .04), and the square term was negatively related (b = –2.57, p = .08) to product quality; the difference between the two subgroups is significant ($F_{3, 47}$ = 3.02, p < .05). However, contrary to expectations, for industries with low levels of dynamism, product quality was found to be significantly related to outcome-based rewards (b = 4.54, p = .01) and its square term (b = –4.15, p = .01). The difference between the two subgroups was statistically significant ($F_{3, 47}$ = 3.51, p < .025). This finding suggests a nonlinear relationship between outcome-based rewards and product quality for less dynamic industries rather than for highly dynamic industries. Thus, H_7 was not supported.

Even though the conditions for establishing the inverted-U–shaped relationships between outcome-based rewards and product quality were satisfied in the case of risky projects and competitive or dynamic industries, further analysis revealed that these relationships were nonlinear and monotonically decreasing.[3] The implications of these results are discussed in the following section.

Discussion

The primary objective of this study was to find ways of enhancing NPD performance by drawing attention to the critical but overlooked area of NPD team rewards. This was done by empirically examining the following research questions:

1. How are the internal performance dimensions of CFPDTs affected by equal and position-based distribution of rewards among team members?
2. How are the external performance dimensions of CFPDTs affected by rewards that are linked to the development process rather than the outcome?

We find that when it is easy to evaluate individual performance in teams, a position-based differential reward

[3]We are grateful to one of the anonymous reviewers for bringing this to our attention.

TABLE 2
Regression Results for the Effect of Process- and Outcome-Based Rewards on the External Dimensions of Team Performance

A: Total Sample and Long and Short Product Development Cycles Subgroups

Reward Structures	Speed to Market			Adherence to Budget and Schedule			Level of Innovation			Product Quality			Market Performance		
	Total	Long	Short	Total	Long	Short	Total	Long	Short	Total	Long	Short	Total	Long	Short
Process-based rewards	−.17	−.48***	.10	−.19	−.57***	.08	.00	−.21	.07	−.39***	−.51***	−.30*	−.22*	−.53***	.12
R^2	.03	**.23*****	**.01**	.04	**.33*****	**.00**	.00	.05	.00	.15***	**.26*****	**.09***	.05*	**.28*****	**.01**
Outcome-based rewards	.31**	.36*	.20	.17	.29	.04	.18	.36*	.14	.34***	.37*	.28	.38***	.46**	.25
R^2	.09**	**.13***	**.04**	.03	.08	.00	.03	**.13***	**.02**	.11***	.14*	.08	.15***	**.22****	**.06**

B: Total Sample and High and Low Project Complexity Subgroups

Reward Structures	Speed to Market			Adherence to Budget and Schedule			Level of Innovation			Product Quality			Market Performance		
	Total	High	Low	Total	High	Low	Total	High	Low	Total	High	Low	Total	High	Low
Process-based rewards	−.17	−.36**	−.04	−.19	−.28	−.13	.00	.08	.10	−.39***	−.29*	−.48**	−.22*	−.30*	−.11
R^2	.03	**.13****	**.00**	.04	.08	.02	.00	.00	.00	.15***	**.08***	**.23****	.05*	.09*	.01
Outcome-based rewards	.31**	.20	.42**	.17	.06	.32	.18	.05	.22	.34***	.28	.36*	.38***	.20	.52***
R^2	.09**	**.04**	**.18****	.03	.00	.10	.03	.00	.22	.11***	.08	.13*	.15***	.04	.27***

*$p < .10$.
**$p < .05$.
***$p < .01$.
Notes: In Part A, n (total) = 53, n (long) = 24, n (short) = 29; in Part B, n (total) = 53, n (high) = 31, n (low) = 22. The high and low subgroups for which the Chow test indicates a statistically significant difference are presented in bold.

TABLE 3

Effect of Outcome-Based Rewards on the External Dimensions of Team Performance: Regression Results for Total and Subgroup Samples of High and Low Levels of Product/Project Risk, Competitive Intensity, and Industry Dynamism

Reward Structures	Speed to Market			Adherence to Budget and Schedule			Level of Innovation			Product Quality			Market Performance		
	Total	High	Low	Total	High	Low	Total	High	Low	Total	High	Low	Total	High	Low
A: Product/Project Risk															
Outcome-based rewards	1.16	.98	.94	.05	.80	–.37	1.09	.47	1.75	1.49	3.67***	–.06	.84	1.60	.11
Outcome-based rewards²	–.87	–.82	–.51	.12	–.59	.52	–.93	–.26	–1.73	–1.17	–3.29**	.22	–.46	–1.29	.32
R^2	.11**	.04	.19*	.03	.05	.03	.05	.05	.07	.14**	**.32*** **	**.03**	.15**	.12	.18*
B: Competitive Intensity															
Outcome-based rewards	1.16	2.16	.41	.05	1.36	–1.21	1.09	–.75	2.43*	1.49	2.94**	.45	.84	2.50*	–.24
Outcome-based rewards²	–.87	–1.87	–.08	.12	–1.13	1.31	–.93	.86	–2.19*	–1.17	–2.57*	–.16	–.46	–2.05	.53
R^2	.11**	.14	.11	.03	.08	.05	.05	.02	.18*	.14**	**.25** **	**.08**	.15**	.28**	.09
C: Industry Dynamism															
Outcome-based rewards	1.16	.67	2.23	.05	–.70	2.47	1.09	.81	1.26	1.49	.02	4.54***	.84	.03	2.26
Outcome-based rewards²	–.87	–.38	–1.90	.12	.81	–2.28	–.93	–.66	–1.00	–1.17	.24	–4.15***	–.46	.17	–1.72
R^2	.11**	.10	.16	.03	.03	.09	.05	.04	.08	.14**	**.07**	**.35*** **	.15**	.04	.33***

*$p < .10$.
**$p < .05$.
***$p < .01$.
Notes: For product/project risk and competitive intensity, n (total) = 53, n (high) = 28, n (low) = 25; for industry dynamism, n (total) = 53, n (high) = 27, n (low) = 26. The high and low subgroups for which the Chow test indicates a statistically significant difference are presented in bold.

structure is more effective and leads to greater team member satisfaction. Such a reward structure recognizes the different levels of contribution, responsibility, and risk shouldered by different members of the team. These findings are consistent with the thesis proposed by Nahavandi and Aranda (1994), who argue that for teams to be successful in Western cultures, the team-based approach must be adapted to Western cultural values. Similarly, Cropanzano and Randall (1993) suggest paying close attention to fairness in group reward distribution (i.e., rewards proportional to individual contribution) when dealing with members from individualistic cultures or when superior group performance is desired.

When ease of individual evaluation is low, an equal distribution of rewards was expected to be more effective. Contrary to expectations, equal rewards were negatively related to both team member satisfaction and self-rated team performance. For low ease of individual evaluation, even a position-based differential distribution of rewards showed a weak, negative association with self-rated performance; however, these differences were not statistically significant. Although surprising, these findings can be explained on the basis of procedural justice (Baron and Byrne 1997; Cropanzano and Randall 1993). When ease of individual evaluation is low, a perception of bias and inaccuracy is likely to persist in the minds of team members. Such perceptions of subjectivity/unfairness in the reward and evaluation process may be difficult to dispel and can have a negative influence on both team member satisfaction and team performance, regardless of how the rewards are distributed.

These findings imply that organizations should develop evaluation systems to monitor the performance of individual team members accurately (Pascarella 1997). In a survey of the salary and incentive practices of the NPD function, Feldman (1996) found that of the CFPDTs examined, team members were evaluated by their functional managers 57% of the time, by their team leader 7% of the time, and by a combination of the two 11% of the time. Our qualitative data suggest that functional managers frequently had little knowledge of a member's performance on a CFPDT, which led to inaccurate and biased evaluations. If cross-functional teams are to achieve their full potential in realizing substantial improvements in the NPD process, reward and evaluation systems must be modified accordingly. Simply considering input from those who are most familiar with a team member's performance (e.g., team leaders, other members) could significantly improve the evaluation process. This would make evaluations more accurate and credible and the reward distribution more effective.

An empirical examination of process- and outcome-based rewards yielded some surprising results as well. We had expected that for long and complex products, a process-based structure would be positively related to external dimensions of team performance. However, for long development cycles, process-based rewards had a significant, negative association with speed to market, adherence to budget and schedule, product quality, and market performance, whereas outcome-based rewards had a positive association with speed to market, level of innovation, and market performance. For the total sample, outcome-based rewards showed a significant, positive relationship with product quality.

Similar results were obtained for highly complex products: Process-based rewards showed a negative relationship with speed to market and product quality. However, the negative relationship between process-based rewards and product quality was stronger for less complex products. In contrast, for the total sample, outcome-based rewards showed a positive association with product quality and market performance. The positive relationship between outcome-based rewards and speed to market was stronger for less complex products than the more complex ones. These results indicate that teams respond well to rewards that are linked to outcomes under conditions in which outcomes are more predictable (i.e., when developing less complicated products).

The pattern of results suggests that for NPD projects in general and for long and complex projects in particular, linking rewards to process-based criteria (such as procedures or behavior) is detrimental to team performance, whereas linking rewards to the output produced by the team has a positive influence on the external dimensions of CFPDT performance. These results are consistent not only with recent research on NPD (e.g., Bonner, Ruekert, and Walker 1998) but also with the organizational control literature and expectancy theory. The central tenet of expectancy theory suggests that people are motivated to greater performance when they perceive a clear link between their efforts/performance and rewards (Baron and Byrne 1997). Making rewards contingent on the outcome establishes such a clear link (Merchant 1985). Exceeding established performance criteria results in rewards, and failure to meet them could result in sanctions (Child 1984). Lawler and Rhodes (1976) note that because outcome-based criteria are objective, they are more effective in fostering the behavior required for achieving set goals.

On the basis of agency theory, we suggested that the relationship between an organization and a team is similar to that between a principal and an agent, because both sides try to minimize their respective risks. For risky projects and highly competitive or dynamic industries, we expected that sharing risk between the team and the organization would result in optimal CFPDT performance. Under these conditions, we expected an inverted-U–shaped relationship to exist between outcome-based rewards and the external dimensions of team performance. However, instead of an inverted-U–shaped relationship, a nonlinear and monotonically decreasing relationship was found to exist between outcome-based rewards and product quality for high-risk projects and highly competitive industries. Therefore, for CFPDTs involved in risky projects or highly competitive industries, a completely outcome-based reward structure is likely to be counterproductive.

Similar results were also obtained for less dynamic industries. Turbulence in an industry can lead to vague standards for evaluating performance. However, even conditions under which team outcomes and the standards used to evaluate these outcomes are relatively predictable and stable, CFPDTs are willing to assume only a negligible amount of the risk. A possible explanation may be that the perceptions of industry dynamism are relative. This study was conducted in high-tech industries, which are well known for their highly turbulent and dynamic environments. By the standards of these industries, relatively stable environments may still be turbulent enough to present excessive risk to

CFPDTs. Even in relatively less dynamic environments of these industries, the rules of the game and the standards for measuring success and failure change frequently, which is a source of concern to the teams in our sample. Linking rewards to outcome under these circumstances places the teams at greater risk and has a counterproductive effect on product quality.

For risky projects and highly competitive and less dynamic industries, the relationship between product quality and outcome-based rewards is nonlinear but monotonically decreasing. Product quality decreased with increasing levels of outcome-based rewards (which denotes team risk), which led us to conclude that NPD teams make a clear distinction between the risk to themselves and the risk to the organization. These CFPDTs operate in an extremely risk-averse mode, and the amount of risk they are willing to assume remains highly skewed in their own favor.

Process- and outcome-based rewards exert a complicated influence on the external dimensions of team performance. Our results suggest that though moderating risk (by using process-based reward) makes CFPDTs complacent, high levels of risk (associated with outcome-based reward) make teams vulnerable. Teams respond to reward structures in a manner that minimizes their own risk. Such risk-minimizing behavior on the part of the teams is consistent with agency theory. As Robbins and Finley (1995, p. 131) astutely note, "teams will not carry out business objectives if doing so puts them at risk."

The seemingly contradictory effects of outcome-based reward structures on performance are similar to those seen in the goal-setting theory literature. Similar to rewards, clear and specific goals are expected to motivate higher performance (Locke et al. 1981). However, recent research in goal-setting theory suggests that goals considered ambiguous, risky, or too difficult to achieve are rejected, which leads to lower performance (Earley, Shalley, and Northcraft 1992).

We observe similar effects in our results: Outcome-based rewards have a positive influence on performance, as long as the rewards are considered low risk and achievable (i.e., long and less complex projects). However, industry dynamism can lead to vague standards, and risky projects and competitive environments can result in outcome objectives that are perceived to be too difficult. Under these conditions, teams may reject an outcome-based reward structure, which leads to lower performance. Cases of rejection are more frequent when the outcome is a function of strategy rather than effort and no clear optimal strategy is evident (Earley, Connolly, and Ekegren 1989). Because these conditions are characteristic of the NPD process, the acceptance/rejection of rewards offers another possible explanation for the complicated effect of outcome-based reward structures on CFPDT performance.

Conclusions

Managers can draw four implications from our findings. First, when it is easy to evaluate individual performances in the team, rewarding members differentially on the basis of their position/status in the organizations is likely to result in higher satisfaction among team members, because senior team members bear a disproportionate share of the risk and responsibility associated with the team.

Second, organizations should consider investing in more accurate and unbiased methods of evaluating individual team members. Because both position-based and equal rewards exert a negative influence on performance when ease of individual evaluation is low, better evaluation systems may minimize perceptions of unfairness and inaccuracies in the distribution of rewards. Third, for long or less complex projects, process-based rewards have a negative influence on team performance, whereas outcome-based rewards enhance performance.

Fourth, for risky projects and highly competitive or relatively stable industries, outcome-based rewards exhibit a nonlinear and monotonically decreasing relationship with product quality. Under these conditions, linking rewards to the project outcomes has a detrimental effect on product quality. Our results suggest that NPD teams clearly distinguish between risk to the organization and risk to themselves. Although teams are willing to share some risk with the organization, they tend to minimize their own risk exposure. Reward structures that are most effective in enhancing team performance are those that present minimal risk to the team. Outcome-based rewards that are perceived to be too risky, too vague, or too difficult to achieve are likely to be rejected by the team, which leads to lower product quality.

This study is one of the first to examine empirically the critical issue of how reward structures affect CFPDT performance. In a significant improvement over existing studies, we measure team performance in terms of seven underlying dimensions. Our results show that performance dimensions are not affected uniformly by the reward structures. This lends support to our argument that CFPDT performance must be disaggregated to develop a clearer picture of the NPD process. Many of our results are counterintuitive and challenge conventional wisdom. We hope that these findings will encourage both academicians and practitioners to reexamine some currently accepted theories and practices.

Readers should bear in mind some caveats when interpreting the results of this study. This study was conducted on NPD teams in high-tech industries, and therefore the results may not generalize to teams in other contexts and industries. Some measures of reward structures used here performed below expectations and could be further refined in the future. Another possible limitation is that all members were not surveyed in each team. Reliance on key respondents may bias the data; however, we sampled multiple respondents in each team to minimize such bias. Performance measures used here are largely self-reported, perceptual, and relative. Olson, Walker, and Ruekert (1995) argue that these kinds of measures are justified because organizations are hesitant to share confidential data. Prior research has used multiple respondents to minimize the problems caused by perceptual and self-reported measures and common-method bias (e.g., Ancona and Caldwell 1992a; Henderson and Lee 1992; Olson, Walker, and Ruekert 1995). It is possible that specification errors were introduced in the analysis because of the omission of firm/line-of-business effects. Finally, testing alternative hypotheses resulted in a large number of unsupported hypotheses, which, coupled with low regression coefficients, increases the probability of finding significance by chance alone. We suggest that readers exercise caution when interpreting the results of this study.

The issue of rewarding CFPDTs is ripe with opportunities for further research. Extensions of this study might examine the effect of other reward mechanisms (e.g., financial rewards, formal versus informal rewards, punitive rewards). Future studies could also examine the effect of position-based and equal rewards on the internal and external dynamics of the team. Finally, an examination of team evaluation structures and their effects on CFPDT performance offers a fruitful area of future exploration.

APPENDIX A
Level of Convergence Among the Multiple Respondents on Teams for Each Construct

	Range of Standard Deviations Across Teams				
Construct	Lowest Standard Deviation	Highest Standard Deviation	Average Standard Deviation	Mean	Scale
Outcome-based rewards	.00	1.43	.47	2.19	1–5
Process-based rewards	.14	1.50	.47	3.48	1–5
Equal rewards	.14	1.06	.40	3.12	1–5
Position-based rewards	.00	1.67	.54	3.05	1–5
Ease of individual evaluation	.00	1.01	.39	3.47	1–5
Project/product complexity	.11	1.97	.58	3.51	1–5
Project/product risk	.00	1.50	.60	3.75	1–5
Length of development cycle	.00	24.90	15.60	23.30	(Months)
Competitive intensity	.00	.95	.39	3.68	1–5
Industry dynamism	.06	1.01	.47	2.84	1–5
Speed to market	.11	1.24	.56	2.92	1–5
Level of innovation	.00	1.54	.54	3.68	1–5
Adherence to budget and schedule	.07	1.13	.52	3.49	1–5
Product quality	.05	1.26	.43	3.86	1–5
Market performance	.09	1.16	.59	3.21	1–5
Team/member satisfaction	.08	1.31	.46	3.54	1–5
Self-rated performance	.00	1.66	.45	3.57	1–5

APPENDIX B
Principal Component Analysis of Items Measuring Reward Structures

Items	Factor 1	Factor 2	Factor 3	Factor 4
1. The best performers on our team receive extra rewards.		.69		
2. All team members are rewarded equally for their work on the team, independent of their individual contributions.		.69		
3. The rewards team members receive for working on this team are proportional to their contribution to the team's performance.		.65		
4. Members who perform well on the team are individually rewarded/ recognized in the team for their work.		.62		
5. The rewards team members receive for working on this team are proportional to their individual salaries.			.81	
6. The rewards team members receive for working on this team are proportional to their position in the organization.			.90	
7. The rewards received by our team/individual members are related entirely to the profit contribution attributed to the team.				.70
8. Rewards to the team/individual members are deferred until bottom-line results of the team (e.g., product performance, market share, profitability, sales) are available.				89
9. The team is rewarded for completing major milestones/stages/ phases during the development of the product.	.88			
10. Teamwork behavior is taken into account when evaluating/rewarding the team.	.74			
11. The team is rewarded for meeting certain prescribed conditions when reviewed periodically during product development.	.87			

Notes: Factor 1 corresponds to process-based rewards, Factor 2 corresponds to equal rewards (items 1, 3, and 4 are reverse coded), Factor 3 corresponds to position-based rewards, and Factor 4 corresponds to outcome-based rewards.

APPENDIX C
Construct Definitions and Measures

Construct	Definition	Items	Adapted From
Equal rewards (4 items, alpha = .69)	The degree to which rewards are distributed uniformly among team members.	The best performers on our team receive extra rewards. [R] All team members are rewarded equally for their work on the team, independent of their individual contribution. The rewards team members receive for working on this team are proportional to their contribution to the team's performance. [R] Members who perform well on our team are individually rewarded/recognized in the team for their work. [R]	New scale Deutsch (1968); Faure and Weitz (1993)
Position-based rewards (2 items, alpha = .80)	The degree to which rewards are distributed among team members on the basis of the relative position/status enjoyed by them in the organization.	The rewards team members receive for working on this team are proportional to their individual salaries. The rewards team members receive for working on this team are proportional to their position in the organization.	New scale Deutsch (1968); Faure and Weitz (1993)
Outcome-based rewards (2 items, alpha = .63)	The degree to which team rewards are tied to the bottom line/profitability of the product developed by the team.	The rewards received by our team/individual members are related entirely to the profit contribution attributed to the team. Rewards to the team/individual members are deferred until bottom-line results of the team (e.g., product performance, market share, profitability, sales) are available.	New scale Deschamps and Nayak (1995); Jaworski (1988)
Process-based rewards (3 items, alpha = .68)	The degree to which team rewards are tied to procedures, behaviors, and other means of achieving desired outcomes.	The team is rewarded for completing major milestones/stages/phases during the development of the product. Teamwork behavior is taken into account when evaluating/rewarding the team. The team is rewarded for meeting certain prescribed conditions when reviewed periodically during product development.	New scale Deschamps and Nayak (1995); Jaworski (1988)
Project risk (4 items, alpha = .88)	The magnitude of failure associated with the project.	Our organization has a lot riding on this project. Poor market performance by this product will have serious consequences for our business. Our organization has made a significant investment in the development of this product. The outcome of this project has high strategic value for our organization.	New scale March and Shapira (1987)
Project/product complexity (5 items, alpha = .86)	The degree to which the development process was complicated and difficult.	The product developed by our team was technically complex to develop. Our team had to use nonroutine technology to develop the product. The development process associated with the product was relatively simple. [R] Development of this product required pioneering innovation. The product developed by our team is/was complex.	Hill (1972); Kahn and Mentzer (1992); McCabe (1987)
Length of the product development cycle	A measure of the duration of the project (in months).	Please indicate the number of months that elapsed (or will have elapsed) between the time that this product was first formally approved and the time that it was (or will be) finally introduced/launched in the market.	
Ease of individual evaluation (4 items, alpha = .80)	The ease with which individual performances can be evaluated in the team effort.	It is easy to identify a few individuals on this team without whom this project would not have been possible. It is easy to evaluate what each member contributed to this project. It is easy to evaluate how much each member contributed to this project. It is difficult to evaluate how much effort any member in this team really put into this project. [R]	New scale John and Weitz (1989)

APPENDIX C
Continued

Construct	Definition	Items	Adapted From
Industry competitive intensity (4 items, alpha = .76)	The degree to which companies experience rivalry within their industry.	Competitive pressures have led to firms in this industry spending more of each sales dollar on marketing. Firms in this industry aggressively fight to hold onto their share of the market. Competition in this industry is intense. Firms in this industry follow a philosophy of peaceful coexistence. [R]	Lusch and Laczniak (1987)
Industry dynamism (8 items, alpha = .89)	The perceived frequency of change and turnover in marketing forces in the industry environment.	Frequency of changes in the mix of products/brands available. Frequency of changes in sales strategies. Frequency of changes in product standards. Frequency of changes in customer preferences in product features. Frequency of changes in customer preferences in product quality. Frequency of changes in technology used. Frequency of major competitors entering or leaving the industry. Frequency of changes in customer preference in product price. (Measured on a five-point scale: 1 = "very infrequent," 5 = "very frequent").	Achrol and Stern (1988)
Speed to market (5 items, alpha = .86)	A (time) measure of the pace at which the product was developed by the team.	This product was developed much faster than other comparable products developed by our organization. This product was developed much faster than similar products developed by our nearest competitors. This product could have been developed in a shorter time. [R] The product concept formation (i.e., opportunity identification and product design) took longer than expected. [R] The product commercialization (i.e., product/market testing, production, distribution, promotion, sales) took longer than expected. [R]	New scale Olson, Walker, and Ruekert (1995)
Adherence to budget and schedule (7 items, alpha = .89)	The degree to which the team met its scheduled deadlines and stayed within its budget.	The team made efficient use of its time. The team's project is behind schedule. [R] The team operated in a cost-efficient manner. The team did a good job adhering to its budget. The team did a good job of meeting all of its schedule deadlines. The team's project is over budget. [R] In general, this team operated in an efficient manner.	Ancona and Caldwell (1991, 1992a); Olson, Walker, and Ruekert (1995)
Degree of innovation (6 items, alpha = .85)	The degree of newness of the product under development.	Several product-related innovations were introduced during the development of this product. High-quality technical innovations were introduced during the development of this product. Compared to similar products developed by our competitors, our product will offer unique features/attributes/benefits to the customers. Our product introduces many completely new features to this class of products. Compared to similar products developed by our organization, our product will offer unique features/attributes. Check (one of the following) statement that best (or most closely) describes the product developed by your team [R]: (a) The product is entirely new to both our firm as well as the customers, (b) The product is new to the customers but not very new to our firm, (c) The product is new to our firm but not very new to the customers, (d) The product is neither new to our firm nor new to the customer, (e) Our product is an imitation of an existing product.	New scale Ancona and Caldwell (1992a); Booz, Allen & Hamilton (1982); Olson, Walker, and Ruekert (1995)

APPENDIX C
Continued

Construct	Definition	Items	Adapted From
Product quality (10 items, alpha = .93)	An overall measure of the degree to which the product delivers value to the customer and meets the quality control standards laid out for it by the team/organization.	Quality of this product compares well with similar products offered by our competitors. The product meets the customers' needs. Complaints have been received regarding the poor performance of this product. [R] The product meets the specifications outlined for it. The product is reliable. This product is of a higher quality than competing products available to the customer. The product's performance shows little deviation from expected standards. Quality of this product compares well with other products developed by our organization. The consumers of this product perceive our product to be better than our competitors'. This product will deliver benefits to the customers that are not currently available to them.	New scale Olson, Walker, and Ruekert (1995)
Market performance (6 items, alpha = .91)	A measure of how the developed product is faring in the market, relative to expectations.	Level of sales achieved. Customer satisfaction with the product. Market performance of the product relative to its competition. Chances of the product being a success in the market. Level of initial market penetration. Projected financial returns on this product. (Measured on a five-point scale: 1 = "far below expectations," 5 = "far above expectations").	New scale Meyer (1994)
Self-rated performance (7 items, alpha = .90)	A measure of the team members' perception of their team's performance compared with other teams in their organization.	The quality of the product developed. Team's reputation for work excellence. Attainment of the goals set for the team. Efficiency of the team's operations. Morale of the team. Adherence to schedule. Adherence to budget. (Measured on a five-point scale: 1 = "far below average," 5 = "far above average").	Ancona and Caldwell (1991, 1992a); Van De Ven and Ferry (1980)
Team/member satisfaction (5 items, alpha = .87)	The degree to which association with the team and its project is/was considered to be worthwhile and productive by the team members.	Team members are satisfied with the recognition they get for their work on this team's project. Team members are satisfied with the amount of responsibility they were given on this team. Team members are satisfied with the way this team was managed. Team members are satisfied with the opportunities they were given to use their abilities. Team members are satisfied with the amount of job variety that was offered by this project.	Brayfield and Rothe (1951); Pinto, Pinto, and Prescott (1993); Warr, Cook, and Wall (1979).

Notes: Unless otherwise mentioned, all items were measured on a five-point Likert-type scale (1 = "strongly disagree," 5 = "strongly agree"). [R] denotes reverse coding.

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