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## **First Among Equals: The Effect of Team Leader Characteristics on the Internal Dynamics of Cross-Functional Product Development Teams**

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### **Abstract**

Drawing upon the Path-Goal Theory of leadership, this study examines the effect of team leader characteristics on an array of conflict resolution behavior, collaboration, and communication patterns of cross-functional new product development (NPD) teams. A hierarchical linear model analysis based on a survey of 246 members from 64 NPD teams suggests that participative management style and initiation of goal structure by the team leader exert the strongest influence on internal team dynamics. Both these leadership characteristics had a positive effect on functional conflict resolution, collaboration, and communication quality within the NPD team; while discouraging dysfunctional conflict resolution and formal communications. Comparatively, team leader's consideration, initiation of process structure, and position had a surprisingly weak effect on internal team dynamics. Further the findings underscore the differential effects on various dimensions of team dynamics, the importance of controlling for project and team characteristics, and the use of multi-level modeling for studying nested phenomena related to NPD teams. Implications of these findings are discussed.

### **Introduction**

Recognizing the long-term competitive advantage offered by successful new product development (NPD), organizations are relying heavily on cross-functional teams to improve their NPD processes (Barczak and Wilemon 1992; Griffin 1997; McDonough 2000; Ulrich and Eppinger 1995; Sarin and Mahajan 2001; Sarin and McDermott 2003; Wind and Mahajan 1997). Typically these teams, comprised of individuals drawn from a variety of functional specialties within the organization, are responsible for taking a product from conceptualization to commercialization.

Growing popularity and anecdotal evidence notwithstanding, the results achieved from the use of cross-functional teams in NPD efforts have been decidedly mixed (Barczak and Wilemon 1989; Katzenbach and Smith 1993; Sarin and Mahajan 2001). Among other reasons, this lack of consistent success has been attributed to poor project

leadership, which often fails to appreciate the diversity of cross-functional teams and mismanages team dynamics - essential components to the performance of any NPD team (Henke, et. al. 1993; Parker 1994; Robbins and Finley 1995).

Effective project leadership has been identified as one of the most important mechanisms for not only managing team dynamics, but also for steering the teams successfully and efficiently through the new product development process (McDonough and Griffin 1997). Team leaders coach team members, help develop their capabilities, foster interactions and learning within the team, and champion the team's activities to others in the organization (Ancona and Caldwell 1992a; Barczak and Wilemon 1992; McDonough and Barczak 1991; McDonough and Griffin 1997; Sarin and McDermott 2003). Thamhain and Nurick (1994) suggest that effective project team leaders are social architects who understand the interaction between organizational and behavioral variables; suggesting that such team leaders should be able to minimize dysfunctional conflict and foster a climate of active participation.

Despite the focused attention from the academic community, much of the past research in the NPD literature is based largely on anecdotal data (e.g., Jassawalla and Sashittal 2000), case studies (e.g., Hershock, Cowman, and Peters 1994), or qualitative data (e.g., Barczak and Wilemon 1989; Donnellon 1993). Although some studies (e.g., McDonough 1993; Norrgren and Schaller 1999) have explored NPD team leadership empirically, these studies were limited in their scope by the univariate analyses employed. Moreover, when empirical examinations were undertaken, few studies controlled for the characteristics of the team or the project, which could have profound effects on how team leadership effects the internal dynamics and performance of the NPD teams (Ancona and Caldwell 1992b; Griffin 1979; Sarin and Mahajan 2001; Sarin and McDermott 2003). The NPD literature lacks a comprehensive and robust empirical examination of the influence of team leadership on the dynamics and performance of cross-functional new product development teams. The present study addresses this void in the NPD literature by empirically examining the effect of team leaders' management styles and position on an array of internal NPD team dynamics. Such a comprehensive examination is critical for understanding the inherent trade-offs and synergies involved between various dimensions of team dynamics.

Drawing on the Path-Goal theory of leadership (e.g., Evans 1970; House 1971), this study focuses on the team leader's management style in terms of his/her interactions with team members, style preferences for organizing work, and position/power in the organization (Yukl 1994). The effects of these team leader characteristics on three broad areas of internal team dynamics are examined: conflict resolution behavior, collaboration, and communication behavior. In addition, we control for key NPD team characteristics such as team size and functional diversity, and for project characteristics including project length, complexity and risk. Hierarchical linear modeling (HLM) is used to analyze the data, which affords a number of analytical and interpretive advantages over methods previously employed in research on NPD teams.

## Theoretical Background

### *Team Leader Characteristics*

The team leader plays a pivotal role in setting the work climate within the team, motivating team members and affecting their behavior (Norrgren and Schaller 1999; Burke et al 2006). Team leaders direct the manner in which the NPD team presents itself and its ideas to achieve personal and organizational goals (Barczak and Wilemon 1989; McDonough 2000; Sarin and McDermott 2003).

Yukl (1994) suggests that leaders' effectiveness is derived from four sources, including (a) the level of power/influence possessed by the leader, (b) how the leader interacts with others, (c) the leaders' personal qualities, and (d) the situation in which the leader is asked to lead. Given their managerial controllability, this research focuses on the first two sources of leader effectiveness: the NPD team leader's power/influence (as reflected by position in the organization), and interactions with the members of the NPD team, as reflected by his/her management style (Muczyk and Reimann 1987; Sarin and McDermott 2003). The *Path-Goal Theory of Leadership* (e.g., Evans 1970, House 1971) is used to help explain the dynamics of these effectiveness dimensions.

The basic premise of the Path-Goal Theory of Leadership is that a primary function of the leader involves clarifying and outlining the kinds of paths/behaviors that will lead to goal attainment and valued rewards (Griffin 1979). Four

distinct characteristics/behaviors of the team leader related to his/her management style can be identified based on this framework (Burke et al 2006; Evans 1970; House 1971; Griffin 1979; Yukl 1994; and Antonioni 1996):

- (a) *Participative Leadership or Participation.* Participation is the degree to which the team leader invites members' involvement in the decision making process. Participative leaders consult with the members of their teams, solicit their input, and take these suggestions into account when making decisions. Participation represents the way the leader behaves toward others as well as his influence over the team members.
- (b) *Supportive Leadership or Consideration.* Consideration is the degree to which the team leader is friendly and approachable, and demonstrates interest in the well being of the team members. It indicates his/her respect for others and conveys cues about his/her own personal qualities. By treating others with respect considerate team leaders create a pleasant work environment.
- (c) *Achievement-Oriented Leadership or Initiation of Goal Structure.* Goal structuring is the degree to which the team leader conveys to the members what outcome or objective is expected of them. By goal structuring team leaders set challenging goals for the team members, expecting them to assume responsibility and perform to their highest level. Through the use of such behavior team leaders show confidence that the members of the team will put forth the level of effort necessary to attain the goals set for them.
- (d) *Directive Leadership or Initiation of Process Structure.* Process structuring is the degree to which the team leader organizes and directs the activities of team members. Process structuring by team leaders gives specific guidance to the team members regarding what needs to be done and how it should be done. The team leader schedules the work to be done, the rules and regulations to be followed, and maintains standards of performance.

Finally, an additional source of team leaders' effectiveness identified by Yukl (1994) is considered: the level of power/influence possessed by the leader:

- (e) *Team Leader's Position.* Team leader's position is a measure of the formal as well as informal power and influence enjoyed by the team leader within the organization. Team leaders in high position enjoy a high stature in the organization, and are well respected for their management and/or technical skills. Such leaders tend to be politically savvy and well networked within the organization. As a result they are able to acquire needed resources, promote the team's project within the organization, and shield the team from unwanted interference and pressures when needed.

Following Sarin and McDermott (2003), these five team leader characteristics were considered because they are not only managerially controllable, but also strongly supported by established theoretical frameworks (i.e., Yukl 1994; Evans 1970; House 1971).

### ***Internal Dynamics of NPD Teams***

Healthy internal dynamics are essential for effective cross-functional NPD teams, and consequently the successful development of new products (e.g., Burke et al 2006). Specifically, the conflict resolution behaviors (e.g., Pinto, Pinto and Prescott 1993; Song, Xie and Dyer 2000); collaboration (e.g., Jassawalla and Sashittal 1998; Pinto, Pinto, and Prescott 1993), and communication behaviors (e.g., Ancona and Caldwell 1992b; Griffin and Hauser 1992) of cross-functional NPD teams have been shown to have a tremendous impact on their performance. However, the mismanagement of these internal dynamics is among the most oft cited barriers to effective NPD team functioning (Henke, Krachenberg and Lyons 1993). In this study, the effect of team leader characteristics on three types of internal team dynamics is considered: conflict resolution strategies, collaboration, and communication behaviors.

*Conflict Resolution Strategies.* Individuals from different functional backgrounds develop different thought worlds and perspectives (Dougherty 1992; Maltz and Kohli 1996; Sarin and McDermott 2003). Besides developing different worldviews, differences can also result from variety in procedures or terminology followed by each

functional area, differences in information processing techniques used, or differences in task/role ambiguity tolerated (Kolb and Rubin 1990). These differences may create conflict, which is inherent in all cross-functional teams (Parker 1994; Sarin and Mahajan 2001). It is not the existence of conflict, per se, but rather the mechanisms used to resolve it that is of interest in terms of the effective functioning of NPD teams (Amason 1996; Pinto, Pinto and Prescott 1993).

Research on conflict management (e.g., Blake and Mouton 1964; Thomas 1977; Song, Xie and Dyer 2000) identifies different mechanisms for resolving conflicts. These include *confronting*, which is open discussion of the disagreement; *compromising*, or mutual bargaining amongst the disagreeing parties; *smoothing*, meaning building on the areas of agreement; *forcing*, or the coercive imposition of a solution by an individual or a group on others, and *withdrawal*, meaning refusal to deal with the conflict. Cross-functional NPD teams may exhibit all of these forms of conflict resolution to varying degrees.

Amason (1996) suggests that depending upon how it is resolved, conflict can either be functional (productive) or dysfunctional (disruptive). Dysfunctional forms of conflict resolution such as forcing or withdrawal compel one disagreeing party to concede, either involuntarily or under duress, in order to eliminate further conflict. Such a “win-lose” situation is ineffective, and can decrease team morale, productivity, and satisfaction (Muczyk and Reimann 1987; Thomas 1977). The preferred or more functional mechanisms for resolving conflict include confronting, compromising, and smoothing. These may enhance team operations by bringing together the ideas of all parties, and aid in reaching a solution that satisfies or benefits all parties involved in the conflict (Kolb and Rubin 1990; Song, Xie and Dyer 2000; Thamhain and Nurick 1994).

*Collaboration.* Collaboration is defined as the degree to which the members of the NPD team work together to accomplish specific tasks (Jassawalla and Sashittal 1998; Pinto, Pinto and Prescott 1993). Collaboration is indicative of effective team dynamics and an antecedent to improved team performance (Ancona and Caldwell 1992a; Pinto, Pinto and Prescott 1993). While some researchers (e.g., Thomas 1977) consider *collaboration* as yet another form of functional conflict resolution strategy; others (e.g., Jassawalla and Sashittal 1998; Pinto, Pinto and Prescott 1993) suggest that it as a much broader construct indicative of general integrative and supportive interpersonal cooperation among team members. While some overlap is expected with functional conflict resolution strategies, collaboration is considered to be a distinct but related component of the internal dynamics of NPD teams.

*Communication.* Poor communication among team members has long been considered a detriment to effective operation (Wilemon and Thamhain 1983; Henke, Krachenberg and Lyons 1993); while effective communication among team members has been linked to greater NPD productivity and performance (Ancona and Caldwell 1992b; Griffin and Hauser 1992). Much of the focus in the extant literature has been on the *frequency* of communication between team members, with the general consensus being that higher communication frequency is positively associated with NPD performance (e.g., Ancona and Caldwell 1992b; Gladstein 1984). Maltz (2000), however, notes that there is an inherent and erroneous assumption in the NPD literature that all types of cross-functional communication are equally important, or that increased communication frequency equals good information quality. Meanwhile, the focus on communication frequency has resulted in other important dimensions of communication remaining under-explored (Maltz 2000; Van de Ven and Ferry 1980).

Although important, frequency is not the only relevant aspect of NPD team communication that needs to be considered. Team communication is a broad concept that encompasses additional attributes. For example, communication *quality* has been suggested as a critical element in improving communication (Bauer and Green 1996), especially across different functional areas (Maltz 2000). Communication quality can be measured in terms of its accuracy, clarity, detail, relevance, and timeliness (Van de Ven and Ferry 1980).

Similarly, information exchanges take place not only through formally designated channels (i.e., meetings, memos, letters, etc.), but also through informal mechanisms (i.e., impromptu meeting, hall talk etc.) (Maltz and Kohli 1996; Van de Ven and Ferry 1980). Maltz and Kohli (1996) suggest that while informal communication may be more timely, formal communication tends to be more accurate and detail-oriented. Therefore, in instances where speed and innovation are important, more informal channels of communication may be desirable; while in other cases, where adherence to budget and schedule, and product quality are important, more formal channels of

communication might be preferable. As such, communication *formality* may be regarded as another appropriate indicator of team interaction and communication (Kezsbom 2000).

What is needed in the literature is an examination of a broad set of leader characteristics on a comprehensive array of conflict resolution behaviors, collaboration, and communication behaviors of NPD teams to gain insights that can translate to actionable prescriptions for NPD managers. Particularly, the simultaneous consideration of a variety of internal dynamics can help understand how the characteristics of the NPD team leaders differentially affect various aspects of internal team dynamics.

## **Conceptual Framework**

The conceptual framework proposed in this study is shown in Figure 1. In the following section we discuss the effects of specific team leader characteristics on the internal dynamics of cross-functional NPD teams.

### ***The Effect of Team Leader Participation and Consideration on Internal Team Dynamics***

Participation and consideration are perhaps the most visible indicators of a team leader's management style. *Participative* team leaders consult their team members, solicit their input, and involve them in the decision making process (Burke et al 2006; Evans 1970; House 1971; Griffin 1979; Yukl 1994; and Antonioni 1996). Thomas (1977) suggests that the key to resolving conflicts in a group is to understand the underlying power structure within the group. A participative team leader creates an environment in which power is dispersed more evenly among the team members. Such power equity limits the ability of individuals or subgroups to unduly dominate the conflict resolution process in the team at the expense of others, thereby creating a more open and productive approach to resolving conflicts as they occur (Norrgren and Schaller 1999; Burke et al 2006). Participation sets the tone in which the leader exerts his/her influence over the team, and has been shown to be positively related to learning within NPD teams (Sarin and McDermott 2003). Thus participative leadership in NPD teams should therefore be positively related to the use of functional conflict resolution strategies, and negatively related to the use of dysfunctional conflict resolution strategies within the team.

Studies of high-involvement leadership suggest that when leaders delegate decision-making authority, team members become more actively engaged in discussions and communication among them improves (Kidd and Christy 1961; Wilemon and Thamhain 1983). In contrast, low-involvement or autocratic leaders discourage team members from actively communicating and participating in team activities (Bolman and Deal 1993; Stewart and Manz 1995).

When a team leader actively engages team members in the decision making process, members have an opportunity to make a contribution to how a new product development project should proceed (McDonough 2000). As they seek to make their contributions in a well-informed manner, the relevance and reliability of the information exchanged increases (Kidd and Christy 1961; Peterson 1997), increasing the communication and cooperation within the team (Maltz 2000). Participation by the team leader sets a more inclusive work environment, which encourages team members to interact with each other using informal rather than formal channels of communication. Therefore participative behavior by team leaders is likely to be related to greater frequency and quality of communication within NPD teams, and greater team collaboration. Greater participation is also likely to be associated with the use of less formal channels of communication.

*Considerate* team leaders demonstrate concern and interest for the well being of their team members. They are friendly, approachable, and treat others with respect. In so doing, they not only convey cues about their own personal qualities, but also create a pleasant work environment in general (Burke et al 2006; Evans 1970; House 1971; Griffin 1979; Yukl 1994; and Antonioni 1996). By being perceived as approachable and empathetic, a considerate team leader creates an environment of psychological safety that encourages team members to openly voice dissenting opinions without fear of reprisal or backlash (Edmondson 1999). This allows the team members to pursue constructive approaches to settling disagreements within the team (Burke et al 2006; Norrgren and Schaller 1999; McDonough 2000). Thus team leader consideration is expected to be positively related to collaboration and the use of functional conflict resolution strategies; and negatively related to the use of dysfunctional conflict resolution strategies within NPD teams.

Additionally, due to the cultural norms set by his/her own behavior as a model, considerate team leaders encourage more frequent communication, foster a nurturing environment, and instill a willingness among team members to listen to one another (Buess 1996). As a result, team communication tends to be more honest, spontaneous, and unstructured (Peterson 1997). Thus consideration by NPD team leaders is expected to be positively related to communication frequency and quality; and negatively related to the formality of internal communication.

### ***The Effect of Initiation of Goal and Process Structure on Internal Team Dynamics***

In general, initiation of structure is conceptualized as the degree to which supervisors assign tasks, prescribe behaviors, and focus actions and expectations towards process performance and/or goal achievement. In the NPD context, initiation of structure is often used to influence team member behavior and performance via the work environment (Antonioni 1996; Porter and Lilly 1996). Extant literature (e.g., Teas 1981; 1983; Cleland 1999) suggests that initiation of structure can take two distinct forms: structuring that is focused on outlining the goals/expectations of the end result of the project (goal structuring), and structuring that is focused on outlining the activities/behaviors for achieving the desired results (process structuring).

*Goal structuring* is defined as the degree to which the team leader conveys to the members what outcome or objective is expected of them. In so doing, the team leader sets challenging goals for the team members and expects them to take responsibility for delivering on those goals (Burke et al 2006; Evans 1970; House 1971; Griffin 1979; Yukl 1994; and Antonioni 1996). By engaging in goal structuring, the team leader demonstrates confidence that the members of the team will perform to a high level, and put forth the effort necessary for attaining the goals outlined (Teas 1981, 1983).

A clear exposition of expectations and expected outcomes by the team leader helps focus the team on a superordinate goal and helps the team members develop a stronger sense of the team mission and identity (Antonioni 1996; McDonough 2000; Sethi 2000). Such goal structuring encourages team members to share problems and work cooperatively toward the common overarching goal (McDonough 2000), creates a learning environment within the team (Sarin and McDermott 2003), and encourages functional conflict resolution strategies over dysfunctional ones (Antonioni 1996). Thus initiation of goal structure by the team leader is expected to be positively related to collaboration and the use of functional conflict resolution strategies; and negatively related to the use of dysfunctional conflict resolution strategies within the NPD team.

By explicitly stating goal expectations, team leaders empower members to seek information related to their own activities, to confer with others to achieve their objectives (Bolman and Deal 1993), and to bypass traditional and more formal channels of communication, if necessary (Sarin and McDermott 2003). Antonioni (1996) suggests that implementation of a goal-focused structure is likely to increase project-related communication. Therefore, initiation of goal structure by the team leader is expected to be positively related to the frequency and quality; and negatively related to the formality of internal communication within the NPD teams.

*Process Structuring* on the other hand is defined as the degree to which the team leader organizes and directs the activities of team members, by giving them specific guidance as to what needs to be done and how it should be done (Burke et al 2006; Evans 1970; House 1971; Griffin 1979; Yukl 1994; and Antonioni 1996). Initiating of process structure involves scheduling of the work to be done, clarifying the rules and regulations to be followed, and maintaining performance standards (Teas 1981, 1983).

While process structuring ensures that the behaviors and activities of the team members are in sync with project goals, it can limit opportunities for new direction (Floyd 1992). Excessive structuring of processes can undermine the flexible, autonomous, and decentralized nature of the team approach to NPD, innovation and creativity (McDonough 2000; Parker 1994). However, a lack of process structure can create ambiguity about the roles, activities, and responsibilities of team members, leading to confusion and chaos (Wilemon and Thamhain 1983). A lack of structure regarding workable plans and daily activities of the NPD team increases the potential for conflict and dysfunctional conflict resolution (Porter and Lilly 1996). Therefore, initiation of process structure is expected to be positively related to collaboration and the use of functional conflict resolution strategies; and negatively related to the use of dysfunctional conflict resolution strategies within NPD teams.

Process structuring favors a management style that is more definite, and focused on achieving positive results through a process of formal delineation (Peterson 1997). Many team leaders see such a directive management style as an approach to reducing the uncertainty inherent in the NPD process. Tightly structured organizational environments make interactions within groups less frequent, less spontaneous and more formal (Carzo 1963). However, Maltz and Kohli (1996) indicate that with greater formality, information becomes more reliable, more accountable, and more relevant, improving the quality of communication. Therefore, initiation of process structure by the team leader is expected to be positively related to the quality and formality; and negatively related to the frequency of internal communication in NPD teams.

### ***The Effect of Team Leader Position on Internal Team Dynamics***

The team leader's position within the organization indicates the level of power and influence s/he enjoys (Sarin and McDermott 2003). The team leader's position may serve as a legitimizing force for the team's activities (Gilmore 1982). A higher level of perceived power may also enhance the trust team members have in their leader (Maltz and Kohli 1996). Thus, a team leader with greater position power is likely to be viewed as someone who can get things accomplished on behalf of the team. Given the time constraints placed on them, these leaders create a learning environment within the team by delegating authority and decision-making to team members (Sarin and McDermott 2003). This is not only likely to result in increased interactions between team members, but may also encourage the team to operate in a more collaborative manner.

The stature and political clout of team leaders in high positions suppresses distracting activities and helps focus the team on the job at hand (Sarin and McDermott 2003). However, a high position in the organization limits the availability of these team leaders for informal interactions. As such the communication within the team is expected to take a more formal tone when team leaders hold more senior level positions. Much of the interactions are likely to occur in a planned rather than spontaneous manner. Thus the team leader's position is expected to be positively related to not only collaboration, but also the frequency and formality of the communication within the NPD team.

### ***Control Variables***

Extant literature suggests that in addition to the characteristics of the team leader, the internal dynamics of the NPD team are likely to be effected by the characteristics of the team itself. Clearly, the management styles that work well for small teams are not as likely to succeed for larger ones. Similarly, the functional make-up (diversity) and size of the team are well known to influence the internal dynamics of NPD teams. Therefore following earlier research on NPD teams (e.g., Ancona and Caldwell 1992b; Sarin and McDermott 2003), size and functional diversity of the team are controlled for in this study. Similarly project characteristics such as length, complexity and risk have been identified as having a significant impact on the internal dynamics and performance of the NPD teams (e.g., Sarin and Mahajan 2001; Sarin and McDermott 2003), and are therefore added as control variables as well.

## **Methodology**

### ***Study Context, Sample Selection and Data Collection***

This study was conducted as part of a larger examination of NPD teams. Given their extensive use of cross-functional teams in new product development activities, the high-tech industries were chosen as a context for this study (Ancona and Caldwell 1992a; 1992b; Sarin and Mahajan 2001; and Sarin and McDermott 2003). Data were collected in two phases. In Phase I, in-depth qualitative field interviews were conducted with team members and managers of nine Fortune 1000 companies. These data were used to better understand the issues involved and to help develop measures for constructs where scales were not available in the literature. In Phase II, a survey instrument was used to collect data collected from 13 divisions of 6 Fortune 1000 firms to test the model proposed in Figure 1. The revenues of the participating divisions ranged from \$100 million to over \$1 billion. Four of these six organizations were drawn from Phase I organizations. The remaining five organizations were unable to participate due to either the sensitivity of new product information or lack of time. Therefore, two new organizations were recruited to participate in Phase II of the study.



Through personal contacts and referrals, a key liaison was identified in each organization, and asked to identify both successful and unsuccessful NPD projects for possible inclusion in the study. To be included in the study, projects were required to meet three criteria. First, to control for noise due to inter-organizational factors, only intra-organizational NPD projects were considered. Second, only NPD projects with products bound for the open market were considered. Third, only projects introduced within the previous twelve months, or at an advance stage of development were considered. In the final sample, survey data were collected from 246 members of 64 cross-functional new product development teams.

The average duration of the sampled NPD projects was 24 months. Size of the project teams ranged from three to twenty-two, with the average team consisting of little over seven members. Responses were obtained from individuals representing various functional backgrounds and hierarchical levels.

### ***Measures***

Wherever possible, existing scales were used to measure the constructs outlined in the study. In cases where no existing scales were available, measures were adapted from the literature or the closest applicable scales. The operational definitions and scale items used to measure the constructs in this study are presented in the Appendix. Unless otherwise stated, all constructs were measured using multi-item 5-point Likert scales (1= strongly disagree, ... 5= strongly agree). The conflict resolution strategies were measured using a five point Likert-type scale, where respondents indicated the extent to which one or more members of their team carried out listed activities (1=very infrequently, ... 5=very frequently). Functional diversity of the team was measured using an entropy index developed by Ancona and Caldwell (1992b).

Standard procedures were used to refine the scales, and to assess their psychometric properties (Nunnally 1978). First, Exploratory Factor Analyses were used to establish the unidimensionality of each scale. Second, the internal consistency of each scale was assessed using Cronbach's Alpha. Lastly, Confirmatory Factor Analyses were used to establish the convergent and discriminant validity of the scales using procedures outlined in the literature (Venkatraman 1989).

The reliability coefficients for the scales are also presented in the Appendix. All scales (except two) demonstrated satisfactory psychometric properties. The reliability coefficients for initiation of goal structure (.66) and smoothing (.62) were below the .70 threshold recommended by Nunnally (1978). However, consistent with past studies (e.g., Sarin and Mahajan 2001; Sarin and McDermott 2003) coefficients in this range were considered close enough to be acceptable.

### ***Model Description and Analysis***

Traditionally research on NPD teams has either analyzed the data at the individual level, or aggregated responses from the team members to obtain a team level response. While analyzing nested data at the individual level ignores the interdependence between observations, averaging individual responses loses valuable variation at the lower level (Kreft and Leeuw 1990). For nested data, such as NPD teams, analyses using Hierarchical Linear Modeling provide a more accurate perspective (Kreft and Leeuw 1998; Sarin and McDermott 2003).

The HLM methodology is particularly well suited to analyzing nested data in which micro-level observations (i.e., individuals) are present within macro-level observations (i.e., group/team) (Kreft and Leeuw 1998; Hoffman, Griffin and Gavin 2000). HLM allows one to investigate both lower-level and higher-level variance in the outcome variable while maintaining the appropriate level of analysis for the independent variables (Klein and Kozlowski 2000, Hoffman, Griffin and Gavin 2000, p.471). In the two-level HLM analysis used in this study, the lower level of analysis (individual team member) is referred to as Level 1 (L1), and the higher level of analysis (team) is referred to as Level 2 (L2).

To test the model in Figure 1, each dimension of internal team dynamic (e.g., confronting, collaboration, communication quality) was regressed on to the five team leader characteristics, while controlling for team characteristics (i.e., size and functional diversity) and project characteristics (e.g., complexity, risk and length). The level of analysis of each independent variable was determined by decomposing the total variance of the construct

into its within and between group components using intra-class coefficients (ICC). ICC is described as the ratio of between group variance in construct to its total variance, and has implications for the level at which a particular construct may be analyzed (Hoffman, Griffin and Gavin 2000).

While there are few hard and fast standards to determine an acceptable level of aggregation (Klein et al 2000, p.518), aggregation to the higher level is justified if a significant amount of the variance in the constructs lies between groups (Klein and Kozlowski 2000). Using this rule of thumb, independent variables with 90% or more of their variance within groups (i.e.,  $ICC < .10$ ) were estimated at the individual level (level 1), while those with at least 10% of the total variance between-groups (i.e.,  $ICC \geq .10$ ) were estimated at the group level (level 2). Table 1 shows the intra-class coefficient and level of analysis for the independent and control variables used in this study. Based on the ICCs, all independent and control variables were aggregated to the group level, with the exception of the initiation of goal and process structure variables

## Results

Results (unstandardized coefficients) of the HLM analysis presented in Table 2 show strong support for the conceptual model proposed in Figure 1. Overall, we find that after controlling for team and project characteristics, the team leader's characteristics explain a significant amount of variance in the internal dynamics of the team, especially in the confronting (.39), collaboration (.65), communication quality (.42) and formality (.52) outcome variables.

Of the characteristics examined in this study, participative behavior and initiation of goal structure by the team leader appear to have the most influence on the internal dynamics of NPD teams. In particular and as expected, team leader participation has a strong positive relationship with functional conflict resolution behaviors such as confronting ( $\gamma = .38, p \leq .001$ ) and smoothing ( $\gamma = .30, p \leq .001$ ); and a strong negative relationship with dysfunctional conflict resolution behaviors like forcing ( $\gamma = -.34, p \leq .001$ ) and withdrawal ( $\gamma = -.33, p \leq .01$ ). NPD teams with participative leaders also displayed greater collaboration ( $\gamma = .31, p \leq .001$ ), communication frequency ( $\gamma = .16, p \leq .01$ ) and quality ( $\gamma = .22, p \leq .001$ ). Also consistent with expectations, participative behavior was seen to lead to less formal communication within the team ( $\gamma = -.06, p \leq .05$ ).

In contrast to past research (e.g., Antonioni 1996; McDonough 2000; Norrgren and Schaller 1999) our results indicate that, after controlling for team and project characteristics, the influence exerted by team leader consideration on the internal team dynamics was surprisingly weak. Consideration was positively related to functional conflict resolution behaviors like confronting ( $\gamma = .11, p \leq .05$ ) and compromising ( $\gamma = .15, p \leq .001$ ), but little else. Further, members of teams led by considerate team leaders were likely to communicate with one another less frequently ( $\gamma = -.01, p \leq .01$ ).

Similar weak effects were seen for the initiation of process structure by the team leader. While previous research differed on the expected directionality of the influence of process structure (e.g., Antonioni 1996; McDonough 2000; Parker 1994; Peterson 1997; Porter and Lily 1996; Wilemon and Thamhain 1983), they nonetheless predicted a significant effect on team dynamics. However, as in the case of consideration, we find that after accounting for team and project characteristics, the influence exerted by the initiation of process structure by the team leader was surprisingly sparse. Process structure was positively related to compromising ( $\gamma = .11, p \leq .05$ ) and communication formality ( $\gamma = .03, p \leq .05$ ); it did not have a significant effect on any other aspect of the internal dynamics of NPD teams.

Initiation of goal structure by the team leader, on the other hand, exhibits a significant effect on multiple dimensions of internal team dynamics. Goal structuring was positively related to functional conflict resolution behaviors such as confronting ( $\gamma = .15, p \leq .01$ ) and smoothing ( $\gamma = .16, p \leq .05$ ); and negatively related to dysfunctional conflict resolution behaviors like forcing ( $\gamma = -.23, p \leq .01$ ) and withdrawal ( $\gamma = -.28, p \leq .01$ ). Initiation of goal structure was positively related to communication quality ( $\gamma = .19, p \leq .001$ ) and collaboration ( $\gamma = .18, p \leq .001$ ) within the team, and negatively related to communication formality ( $\gamma = -.03, p \leq .05$ ).

As in the case of consideration and process structure, team leader position also exhibited a surprisingly weak influence on the internal dynamics of NPD teams. Team leader position had a positive effect on collaboration ( $\gamma =$

.07,  $p \leq .05$ ) and communication formality ( $\gamma = .05$ ,  $p \leq .05$ ); but did not affect any other dimension of team dynamics in a significant manner. Finally, results presented in Table 2 demonstrate the importance of controlling for the team and project characteristics, when examining team dynamics. In particular, project characteristics like risk, complexity, and length had statistically significant effects on multiple dimensions of internal team dynamics. The implications of these results are discussed next.

## Discussion and Implications

Although the critical influence of team leader and team dynamics on the performance of NPD teams is well established, the literature lacks a comprehensive examination of how the team leader affects internal team dynamics. Drawing upon the path-goal theory, the objective of this study was to offer an empirical examination of the effect of five 'managerially controllable' team leader characteristics on the internal dynamics of cross-functional NPD teams. The results offer strong support for the basic premise of this study— in the sense that the team leader stands out as “first among equals.”

Our findings indicate that participation and goal structuring exert the most significant and ubiquitous influence on the internal dynamics of cross-functional NPD teams. Rather than the interpersonal characteristics like friendliness, the most influential team leader characteristics revolved around the tasks of NPD teams. Most influential team leaders actively involved the members of their teams in decision-making, and helped set goals and expectations for the team. However, attempts by the team leaders to structure the activities and behaviors of the team members do not show a significant effect on the team's dynamics. This suggests that team leaders have to walk a tightrope in terms of providing structure. Team leaders need to motivate the members by providing super-ordinate goals and helping set high expectations. But then team leaders need to trust the team member to perform their job, and leave them alone to figure out the best way to achieve these overarching goals. Any attempts to micro-manage the process by prescribing behaviors and activities were ineffective in influencing the dynamics of the team.

The overall pattern of results underscores four important issues and contributions of this study. First, internal dynamics of NPD teams are multi-faceted, and the different dimensions are impacted differentially by the characteristics of the team leaders. There are inherent tradeoffs involved between the underlying dimensions of internal dynamics that may warrant a more nuanced approach than previously employed in the study of internal dynamics of NPD teams. Instead of examining one or two dimensions in isolation, this study employs a more comprehensive approach to internal dynamics by examining a wide array of underlying dimensions that acknowledge their differential effects, and the tradeoffs involved therein.

For example, these findings suggest that team leader characteristics account for a significant amount of variance in collaboration, communication formality, communication quality, and confronting within teams. Other team dynamics such as communication frequency, compromising, forcing and withdrawal are not as strongly influenced by the team leader.

Secondly, the results demonstrate that the characteristics of the project and the team have a significant and pervasive influence on the internal dynamics of NPD teams. Therefore, it is critical to control for these characteristics (especially team size and project characteristics like risk, complexity, length etc.) to avoid spurious effects. Accounting for variance due to team and project characteristics ensures that the effects being observed are attributable solely to the phenomena under investigation, such as team leader characteristics in our context.

Third, the results indicate that after controlling for project and team characteristics, the effect of leader characteristics on the dynamics of the team are different than those reported in earlier studies. Some leader characteristics (i.e., consideration, initiation of process structure, and team leader position) that were reported to be influential in past research appear to be less so in our study. On the other hand, team leader characteristics like participation and initiation of goal structure seem to have much more pronounced effects on internal team dynamics.

Specifically, these results indicate that participative behavior by the team leader encourages functional conflict resolution strategies like confronting and smoothing, and discourages dysfunctional conflict resolution behaviors

like forcing of solutions, or withdrawal from conflict. Participative team leaders foster an environment where members of the NPD team collaborate more, and communicate with each other more frequently and less informally. Moreover, a participative management style improves the quality of communication within the team. When a team leader consults with members of his team, solicits their input, and involves them in the decision making process, it creates a level of trust on the team that causes team members to respond by taking ownership and responsibility for the project outcomes. As a result, team members engage in behaviors that are most likely to benefit the team and its mission.

Consideration by team leaders was found to have a weaker than expected effect, significantly impacting only three dimensions of internal dynamics examined. Consideration was positively related to functional conflict resolution strategies like confronting and compromising, but had a surprisingly negative effect on the frequency of communication within the team. When a team leader demonstrates concern for the feelings and well being of his/her team members, members may respond with equal consideration to the team leader and, more importantly, to one another. As a result, they may be more likely to attempt to solve problems through compromise and negotiation so as to account for the feelings and concerns of each team member.

Several explanations are possible for the surprising negative relationship between consideration and communication frequency. It is possible that considerate behavior by the team leader may be mistaken for complacency, and may fail to convey a sense of urgency regarding the task at hand. The team leader's informal, friendly demeanor may either be taken advantage of, or be subtly misinterpreted by the team to mean that relaxing on clearly articulating task oriented communication is acceptable. Especially if these team leaders are seen as too nice to censure unresponsive behavior by the team members, they risk being taken for granted. Alternatively a decrease in communication frequency could be indicative of a lack of residual conflict within the team, resulting from the harmony created by such leaders.

Equally surprising is the weak influence exerted by initiation of process structure on team dynamics. With the exception of compromising conflict resolution approaches and communication formality, process structure was found to have almost no influence on any other dimension of conflict resolution and communication behaviors (or team collaboration). This is probably due to the fact that when team leaders structure processes by which specific outcomes are to be achieved, they can insist upon compromises and specify communication formats and channels. Beyond that, however, the use of process structuring appears to have no effect on team outcomes.

Goal structuring, on the other hand, was the second most influential team leader characteristic examined in this study. Initiation of goal structure by the team leader had almost identical effect to that of participation on conflict resolution behaviors and collaboration. Goal structuring improves confronting, smoothing, and collaborative behaviors within the team; while discouraging dysfunctional conflict resolution behavior. The results indicate that goal structuring by the team leader increases the quality of the communication within the team, at the same time making it more informal. These results suggest that by identifying a specific outcome for the team to achieve, team leaders unify the members behind a common goal, and increase the likelihood that team members will try their best to collaborate with each other to achieve the desired end result, rather than forcing solutions on one another. Focusing the team's attention on end results also helps develop an open style of conflict resolution in the team rather than one of avoidance, as there is a need to see the desired outcome achieved. This goal focus also promotes an increase in the quality of communication among team members, as they attempt to gather the best information available to reach their end result.

After controlling for team and project characteristics, the effects of team leader position on internal team dynamics were weaker than suggested by prior research. The team leader's position has a significant and positive relationship with only two outcomes: collaboration and communication formality. These results suggest that, by virtue of their stature and management skill, such leaders may be able to bring the team members to collaborate to a greater degree. Given their relative position in the organization, however, more layers of management are likely to exist between the leader and the members of the team, thereby increasing the number of steps in the channel of communication. This sets the tone to formalize communication processes and interactions within the team.

Finally, our study employs hierarchical linear modeling to analyze the data and test the proposed model. HLM offers a significant improvement over past research by taking into account variances both at the individual as well as group level in the constructs to test a multi-level model of the proposed framework.

While the present study examines the effect of team leader characteristics on internal team dynamics, research (e.g., Ancona and Caldwell 1992a) points to an equally significant role played by external interaction of NPD teams. Future extensions of this research might examine how the team leader affects the external dynamics of NPD teams, how team leader characteristics affect specific dimensions of NPD performance, and how the contextual effect of team and project characteristics affect the leader – performance relationship. There is clearly a fruitful path of exploration ahead to help NPD team leaders understand the impact of their management styles on team dynamics and subsequent outcomes.

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#### Author Biographies

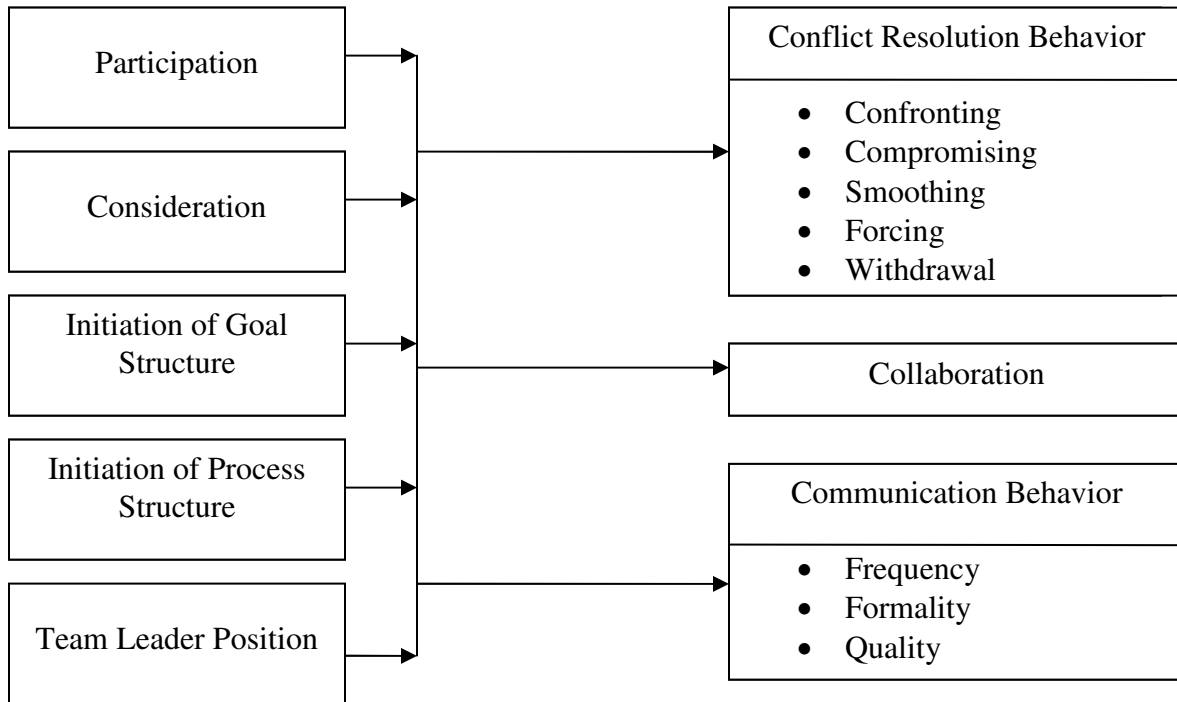
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**Figure 1**

**Conceptual Framework of the Effect of Team Leader Characteristics on the Internal Dynamics of NPD Teams**



**Table 1**

**Intra-Class Coefficients (ICC) and Level of Analysis of the Independent and Control Variables**

<b>Variable</b>	<b>ICC</b>	<b>Level of Analysis</b>
Participation	.107	L2
Consideration	.203	L2
Goal Structure	.074	L1
Process Structure	.004	L1
Leader Position	.211	L2
Team Size	.187	L2
Functional Diversity	.643	L2
Project Length	.257	L2
Project Complexity	.277	L2
Project Risk	.300	L2

**Table 2**

**Effect of Team Leader Characteristics on the Internal Dynamics of NPD Teams: Results of Hierarchical Linear Modeling Analysis<sup>‡</sup>**

INDEPENDENT VARIABLES (df)	DEPENDENT VARIABLES								
	Functional Conflict Resolution				Dysfunctional Conflict Resolution		Internal Communication Behavior		
	CONFRONT	COMPROMISING	SMOOTHING	COLLABORATION	FORCING	WITHDRAWAL	QUALITY	FREQUENCY	FORMALITY
Intercept (63)	.59*	1.30**	.96**	1.25***	5.07***	4.98***	1.42***	1.11***	.81***
PARTICIPATION (63)	.38***	.09	.30***	.31***	-.34***	-.33**	.22***	.16**	-.06*
CONSIDERATION (63)	.11*	.15*	.07	.05 <sup>T</sup>	-.06	-.11	.07 <sup>T</sup>	-.01**	.002
GOAL STRUCTURE (235)	.15**	.05	.16*	.18***	-.23**	-.28**	.19***	.06	-.03*
PROCESS STRUCTURE (235)	.04	.11*	.07	.01	-.002	.07	0.01	.01	.03*
LEADER POSITION (63)	.08	.03	.10	.07*	-.11	-.04	.03	.02	.05**
<i>Control Variables</i>									
Team Size (63)	-.002	.01*	.01*	.004*	.004	-.001	0.004	0.02*	.01**
Functional Diversity (63)	-.01	-.05	-.08	-.02	-.001	.18*	-.07	.19*	.03
Project Length (63)	.001	.01***	-.01***	-.002 <sup>T</sup>	.004 <sup>T</sup>	.01*	.002 <sup>T</sup>	-.006***	-.0003
Project Complexity (63)	.18***	-.06	.12**	.09**	-.16**	-.14*	.03	.14**	.01
Project Risk (63)	-.10*	.16**	-.10*	.01	.15**	.07 <sup>T</sup>	.08**	-.03	-.04**
<b>VARIANCE EXPLAINED</b>	<b>0.39</b>	<b>0.14</b>	<b>0.29</b>	<b>0.65</b>	<b>0.17</b>	<b>.19</b>	<b>0.42</b>	<b>0.10</b>	<b>0.52</b>

\*\*\* p ≤ .001; \*\* p ≤ .01; \* p ≤ .05; <sup>T</sup> p ≤ .10

Level 1, n = 246; Level 2, n = 64

<sup>‡</sup> Unstandardized coefficients

## Appendix: Construct Definitions and Measures

<u>CONSTRUCT</u>	<u>DEFINITION</u>	<u>ITEMS</u>	<u>ADAPTED FROM</u>
<b>Participation</b> (4 items, $\alpha=.81$ )	The degree to which the team leader is perceived to be friendly, approachable, and democratic in his/her interactions with the team members.	<ul style="list-style-type: none"> <li>• Team members can exert influence regarding how the team should function.</li> <li>• Team members can influence decisions of the team leader regarding things concerning the team.</li> <li>• Our team leader frequently asks the team members for their opinion when a problem comes up that involves the project.</li> <li>• Our team leader frequently makes decisions concerning the team, without consulting the team members. [R]</li> </ul>	Sarin and McDermott (2003); Teas (1981;1983)
<b>Consideration</b> (5 items, $\alpha=.83$ )	The degree to which the team leader is friendly and approachable, and demonstrates interest in the well being of the team members.	<ul style="list-style-type: none"> <li>• Our team leader is friendly and approachable.</li> <li>• Our team leader gives advance notice of changes.</li> <li>• Our team leader makes my job pleasant.</li> <li>• Our team leader does little things to make it pleasant to be a member of this team.</li> <li>• Our team leader treats all members of the team as his/her equal.</li> </ul>	Sarin and McDermott (2003); Teas (1981;1983)
<b>Initiation of Goal Structure</b> (3 items, $\alpha=.66$ )	The degree to which the team leader lets the team members know their outcome objectives and expectations.	<ul style="list-style-type: none"> <li>• Our team leader lets the team know what is expected of them.</li> <li>• Our team leader makes his/her attitudes clear to the team members.</li> <li>• Our team leader makes sure that his/her part in the team is understood by the team members.</li> </ul>	Sarin and McDermott (2003); Teas (1981;1983)
<b>Smoothing</b> (3 items, $\alpha=.62$ )	The frequency with which conflicts are resolved by building on the areas of agreement.	<ul style="list-style-type: none"> <li>• Common areas of agreement are emphasized.</li> <li>• Real issues in the disagreement may not be addressed. [R]</li> <li>• Areas of agreement between the conflicting parties are emphasized.</li> </ul>	Blake and Mouton (1964); Howat and London (1980)

<b><u>CONSTRUCT</u></b>	<b><u>DEFINITION</u></b>	<b><u>ITEMS</u></b>	<b><u>ADAPTED FROM</u></b>
<b>Initiation of Process Structure</b> (5 items, $\alpha=.72$ )	The degree to which the team leader organizes and directs the activities of the team members.	<ul style="list-style-type: none"> <li>• Our team leader encourages the use of uniform procedures.</li> <li>• Our team leader decides what shall be done and how it will be done.</li> <li>• Our team leader schedules the work to be done.</li> <li>• Our team leader maintains definite standards of performance.</li> <li>• Our team leader asks the team members to follow standard rules and regulations.</li> </ul>	Sarin and McDermott (2003); Teas (1981;1983)
<b>Team Leader Position</b> (6 items, $\alpha=.76$ )	A measure of the formal as well as the informal power and influence enjoyed by the team leader within the organization.	<ul style="list-style-type: none"> <li>• Our team leader is well respected in the organization for his/her management skills.</li> <li>• Our team leader is well respected in the organization for his/her technical skills.</li> <li>• Our team leader is widely 'networked' in the organization.</li> <li>• Our team leader occupies a high position in the organization.</li> <li>• Our team leader enjoys authority in our organization.</li> <li>• Our team leader has significant decision-making responsibility in our organization.</li> </ul>	Sarin and McDermott (2003); Teas (1981;1983)

**Confronting**  
(6 items,  $\alpha = .87$ )

The frequency with which conflicts are resolved by openly discussing the disagreement and trying to resolve the problem.

- Problems are openly discussed/confronted.
- A rational approach is adopted to resolve the disagreements.
- Conflicts are resolved by focusing on the issues.
- Different alternative approaches of solving the problem are evaluated.
- The best alternative is selected as the solution in resolving the disagreement.
- The problem is confronted until the conflict is resolved.

Blake and Mouton (1964); Howat and London (1980)

**Compromising**  
(3 items,  $\alpha = .72$ )

The frequency with which conflicts are resolved by mutual bargaining amongst the disagreeing parties.

- There is bargaining between conflicting parties.
- There is a search for solutions which will bring some degree of satisfaction to the conflicting parties.
- Conflicting parties give in a little to get a little.

Blake and Mouton (1964); Howat and London (1980)

<b><u>CONSTRUCT</u></b>	<b><u>DEFINITION</u></b>	<b><u>ITEMS</u></b>	<b><u>ADAPTED FROM</u></b>
<b>Forcing</b> (5 items, $\alpha = .88$ )	The frequency with which conflicts are resolved by the forceful imposition of a solution by an individual (or subgroup) over another individual (or subgroup).	<ul style="list-style-type: none"> <li>• Acceptance of one viewpoint is forced at the expense of others.</li> <li>• Resolution of the conflict is characterized by competitiveness.</li> <li>• Solution(s) are forced, to the deterioration of the team climate.</li> <li>• Resolution of the conflict is characterized by win/lose behavior.</li> <li>• Solutions are forced, to the resentment of some team members.</li> </ul>	Blake and Mouton (1964); Howat and London (1980)
<b>Collaboration</b> (11 items, $\alpha = .88$ )	The degree to which the members of the team work together to accomplish specific tasks.	<ul style="list-style-type: none"> <li>• When dealing with a task-related problem, our team seems to be most concerned with finding the best solution.</li> <li>• Interpersonal relationships within the team are such that members know that other members will provide support/encouragement.</li> <li>• When an approach to solving a problem fails, our team focuses on learning from the failure.</li> <li>• The nature of interpersonal relationships in this team is such that others will often act to your disadvantage. [R]</li> <li>• When team members work jointly on problems, they tend to build on each other's ideas.</li> <li>• After a disagreement in the team, everyone gets on with their respective jobs.</li> <li>• Team members regularly share project/team-related information with each other.</li> <li>• In carrying out their assignments, team members act as consultants to each other.</li> <li>• When someone on the team makes an error, others try and help him/her.</li> <li>• In dealing with each other, team members openly discuss what they think/feel.</li> <li>• In interactions with team members, it is acceptable to ask questions about anything one doesn't understand.</li> </ul>	Pinto, Pinto, and Prescott (1993); Aram, Morgan and Esbeck (1971)

<b><u>CONSTRUCT</u></b>	<b><u>DEFINITION</u></b>	<b><u>ITEMS</u></b>	<b><u>ADAPTED FROM</u></b>
<b>Withdrawal</b> (4 items, $\alpha = .83$ )	The frequency with which conflicts are resolved by using an avoidance approach, i.e., by not dealing with the conflict altogether.	<ul style="list-style-type: none"> <li>• Members refrain from arguing about an issue causing a conflict.</li> <li>• There is avoidance of a conflicting issue.</li> <li>• The team does not deal with the disagreement.</li> <li>• There is a tendency to avoid rocking the boat.</li> </ul>	Blake and Mouton (1964); Howat and London (1980)
<b>Internal Communication Frequency and Formality</b>  (13 items composite scale, $\alpha = NA$ )	<p>Frequency is the number of communication events between the respondent(s) and other members of their team over an average three-month period.</p> <p>Formality is the ratio of formal to informal communication events. Formal communication events are denoted by an [F] and informal by an [IF].</p>	<p>Respondents were asked to indicate how frequently they communicate using the following the mechanisms over an average three month period (1=Once or less, ..., 5=More than once per day):</p> <ul style="list-style-type: none"> <li>• <u>Written Communication</u> Memos [F]; Reports [F]; Fax Machine [F]</li> <li>• <u>Oral Communication</u> Formal Group Meetings [F] Scheduled One-to-One Meetings (Face-to-Face) [F] Impromptu Face-to-Face Meetings (e.g., in the hall) [IF] Scheduled One-to-One Phone Conversations [F] Impromptu One-to-One Phone Conversations [IF] Voice Mail [F] Teleconferencing [F]</li> <li>• <u>Electronic Communication</u> E-mail consisting of text only [F] E-mail consisting of text w/graphics and/or spreadsheets [F] Electronic Group Conferencing [F]</li> </ul>	Van de Ven and Ferry (1980); Maltz and Kohli (1996)
<b>Team Size</b> (1 item; $\alpha = NA$ )	The number of members who form the core/primary part of the product development team.	<ul style="list-style-type: none"> <li>• Please indicate the number of members who form the core/primary part of your product development team: _____</li> </ul>	Ancona and Caldwell (1992b)
<b>Project Length</b> (1 item; $\alpha = NA$ )	A measure of the duration of the project (in months)	<ul style="list-style-type: none"> <li>• 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: _____</li> </ul>	Sarin and Mahajan (2001)

<u>CONSTRUCT</u>	<u>DEFINITION</u>	<u>ITEMS</u>	<u>ADAPTED FROM</u>
<p><b>Internal Communication Quality</b>                      (10 items, <math>\alpha = .90</math>)</p>	<p>Quality is a measure of the communication within the team along the dimensions such as: accuracy, clarity, detail congruence, relevance, ease and timeliness.</p>	<ul style="list-style-type: none"> <li>• Information exchanged was reliable.</li> <li>• Information exchanged was easy to comprehend.</li> <li>• Information exchanged was detailed enough to be useful.</li> <li>• Communication exchanged included topics which were of <i>relevance</i> to both the sender as well as receiver of the communication.</li> <li>• Communication exchanged made it difficult to get ideas across.</li> <li>• Information exchanged was current.</li> <li>• The communication/information exchanged was accurate</li> <li>• The information exchanged was ‘actionable’.</li> <li>• It was difficult to get in touch with members of the team.</li> <li>• Communication exchanged included topics which were of <i>interest</i> to both the sender as well as receiver of the communication.</li> </ul>	<p>Maltz (2000); Van de Ven and Ferry (1980)</p>
<p><b>Functional Diversity</b>                      (1 item; <math>\alpha = NA</math>)</p>	<p>The degree of functional heterogeneity in the team.</p>	<p>Please indicate how many members of your product team belong to the following functional areas:</p> <ul style="list-style-type: none"> <li>• Marketing : _____</li> <li>• Manufacturing : _____</li> <li>• Engineering : _____</li> </ul> <p>An entropy based index was used to calculate functional diversity (H):</p> $H = - \sum_{i=1}^s P_i * (\ln P_i)$ <p>Where,                      P = fractional share of team members assigned to marketing, manufacturing, and engineering.                      S = the number of functional areas that can potentially be represented.</p>	<p>Ancona and Caldwell (1992b)</p>



<u>CONSTRUCT</u>	<u>DEFINITION</u>	<u>ITEMS</u>	<u>ADAPTED FROM</u>
<b>Project Risk</b> (4 item; $\alpha = .88$ )	The magnitude of failure associated with the project.	<ul style="list-style-type: none"> <li>• Our organization has a lot riding on this project.</li> <li>• Poor market performance by this product will have serious consequences for our business.</li> <li>• Our organization has made a significant investment in the development of this product.</li> <li>• The outcome of this project has high strategic value for our organization.</li> </ul>	Sarin and Mahajan (2001)
<b>Project Complexity</b> (5 item; $\alpha = .86$ )	The degree to which the development process was complicated and difficult.	<ul style="list-style-type: none"> <li>• The product developed by our team was technically complex to develop.</li> <li>• Our team had to use non-routine technology to develop the product.</li> <li>• The development process associated with the product was relatively simple. [R]</li> <li>• Development of this product required pioneering innovation.</li> <li>• The product developed by our team is/was complex.</li> </ul>	Sarin and Mahajan (2001)