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Determinants of New Product Development Team Performance: A Meta-analytic Review

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New product development (NPD) has become a critical determinant of firm performance. There is a considerable body of research examining the factors that influence a firm's ability to successfully develop and introduce new products. Vital to this success is the creation and management of NPD teams. While the evidence for the use of NPD teams and the factors that determine their success is accumulating, there is still a lack of clarity on the team-level variables that are most impactful on NPD success. This meta-analytic study examines the effects of NPD team characteristics on three different measures of success: effectiveness (market success), efficiency (meeting budgets and schedules), and speed-to-market, requiring incorporation of a broader set of team variables than previous studies in order to capture more factors explaining NPD outcomes. Unlike a typical empirical study that considered no more than two team variables to predict NPD performance, this study combines research spanning eight team variables including team input variables (team tenure, functional diversity, team ability, and team leadership) and team process variables (internal and external team communication, group cohesiveness, and goal clarity). Results from 38 studies were aggregated to estimate the meta-analytic effect sizes for each of the variables. Using the meta-analytic results, a path analytic model of NPD success was estimated to isolate the unique effects of team characteristics on NPD effectiveness and efficiency. Results indicate that team leadership, team ability, external communication, goal clarity, and group cohesiveness are the critical determinants of NPD team performance. NPD teams with considerable experience and led by a transformational leader are more successful at developing new products. Effective boundary spanning within and outside the organization and a shared understanding of project objectives are paramount to success. Group cohesiveness is also an important predictor of NPD outcomes confirming the importance of esprit de corps within the team. The findings provide product development managers with a blueprint for creating high-performance NPD teams.

New product development (NPD) is critical to the success of companies in a global economy. Academic researchers have addressed companies' interests by systematically examining the factors contributing to new product development success. While the critical role of teams in developing new products is well acknowledged, research evidence linking specific team characteristics to NPD success is piecemeal, and provides little guidance for developing high-performing NPD teams. Like searching for the Holy Grail, business executives seek to identify those factors that are likely to increase the chances of success of NPD teams. However, past research in NPD has focused largely on examining market environment, product characteristics, and firm strategy.

The primary objective of this paper is to identify a broader set of team-level variables that predict NPD outcomes, and aggregate the findings across the empirical studies to provide estimates of the impact of each team-level variable on performance. Many researchers have conducted meta-analyses of teams in general (cf., Bowers, Pharmer, and Salas, 2000; De Dreu and Weingart, 2003; Devine and Philips, 2001; Gully, Incalcaterra, Joshi, and Beaubien, 2002), as well as various NPD success factors (Gerwin and Barrowman, 2002; Henard and Syzmanski, 2001; Montoya-Weiss and Calantone, 1994), but they have not focused on NPD outcomes as in the case of teams in general, or examined the effects of NPD team characteristics on outcomes. Without an exception, NPD teams operate in nonroutinized, ambiguous, resource-constrained, and cross-functional environments tasked with creating innovative outcomes. These conditions are not always present in teams in general. Hence, the factors for success in such teams may not be applicable to the specific case of NPD teams. Moreover, in the meta-analyses of NPD success factors, many of the variables selected relate to traditional sources of competitive advantage, which have become less of a determinant of firm-level success in recent years (Daneels, 2002).

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Much of the empirical research on the performance of NPD teams has focused on a very small array of team-level variables. Some variables such as functional diversity have had mixed support in the literature, with some reporting negative effects on NPD outcomes (Pelled, Eisenhardt, and Xin, 1999) and others reporting strong positive effects (Gebert, Boener, and Kearney, 2006). The meta-analytic procedure allows estimation of the cumulative effects of a wider range of team-level variables as well as determines if these differences across studies are due to sample artifacts or other moderators.

The second objective is to extend findings from the first phase described above and estimate the unique effects of each team-level variable on NPD outcomes. While it is important to know the bivariate effects of each team-level variable on NPD outcomes, testing an integrated model to estimate the unique effects of team characteristics on NPD outcomes yields information useful to both researchers and practitioners. This two-step process enables identification of the key determinants of NPD team success.

BIOGRAPHICAL SKETCHES

Dr. Nagaraj Sivasubramaniam (Ph.D., Florida International University) is an associate professor of Leadership in the Palumbo-Donahue Schools of Business at Duquesne University, Pittsburgh, PA. His research focuses on defining and measuring sustainability orientation, modeling climate protection strategies, and examining the organizational impacts of individual and team leadership. His work has been published in *Leadership Quarterly*, *Group & Organization Management*, and other journals. In the classroom, he facilitates student learning in leadership and systems thinking.

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Theoretical Background

Several team performance models have been suggested in the literature (cf., Gladstein, 1984; Klimoski and Mohammed, 1994). These models utilize a systems perspective to identify a set of antecedents or inputs which set the team conditions, a set of dynamic processes that affect how teams interact/work, and a set of enablers that moderate the effects of the inputs and processes on the outcomes. For example, Gladstein (1984) proposed an Inputs-Process-Outputs (I-P-O) model of workgroup effectiveness, wherein group composition and structure were the inputs; communication, boundary management, supportiveness, and conflict were the group processes; and task complexity and environmental uncertainty were the moderators. This I-P-O model has been extended to include a dynamic view of team processes and effectiveness (Ilgen, Hollenbeck, Johnson, and Jundt, 2005; Kozlowski and Ilgen, 2006) seen as embedded in a multilevel system incorporating the emergent dynamics of different processes over time. This contemporary view of team performance is adopted here and suggests that team inputs and team processes interact over time and affect NPD outcomes.

The model is summarized in Figure 1 incorporating four different input variables including team tenure, functional diversity, team ability, and team leadership. Following Marks, Mathieu, and Zaccaro (2001) and Kozlowski and Ilgen (2006), team processes such as internal and external communication are differentiated from emergent states (group cohesiveness) and proximal outcomes like goal clarity.

Team Inputs

Of the four variables characterizing NPD teams, team tenure, functional diversity, and team ability are team design variables in that they define how the teams have been put together. Team leadership is not a team design variable, per se, but is exogenous to the team. Consistent with Gladstein (1984), team leadership was considered as an input variable as it affects how teams function. Key findings from the literature are summarized in Table 1 with the hypotheses listed in the last column.

Team tenure is usually defined as the number of months a group of people have worked together. Alternatively, to capture the turnover of team members, researchers have utilized the coefficient of variation or perceptual measures of team stability. A group generally requires a considerable amount of time before becoming a high-performing team. For example, in a study of 56 aircraft

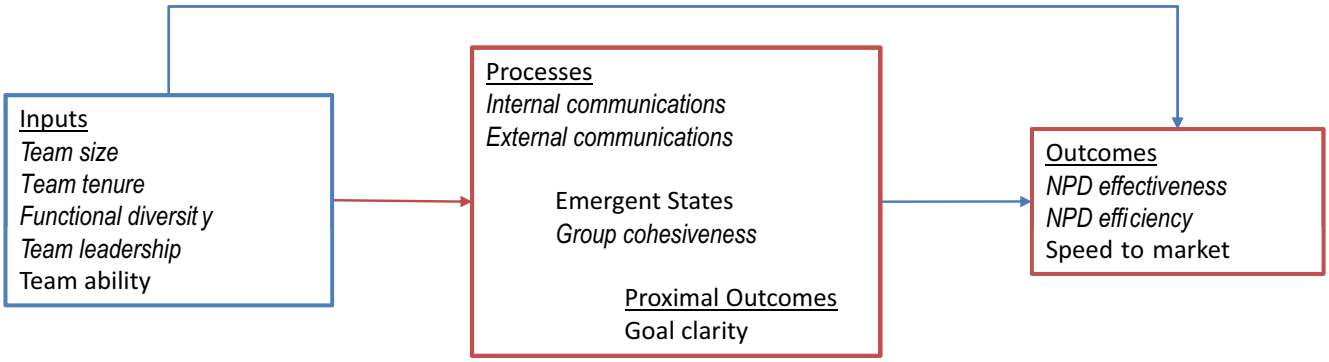

Figure 1. An Inputs-Process-Outputs (I-P-O) Model of NPD Team Performance
Note: The italicized variables were included in the path-analytic model in this paper

engineering teams, the more frequently team members changed, the lower was the team's innovativeness (Gibson and Gibbs, 2006). Akgun and Lynn (2002b) found that NPD teams that remained stable from preprototype through product launch achieved a quicker speed-to-market. As such, it is hypothesized that:

H1: Team tenure is positively related to NPD outcomes.

Functional diversity is defined as cross-functional diversity, indicated by the number of different functions/departments represented in the team. This has been measured using Teachman's (1980) index, Blau's (1977) index, or a simple count of the different functions represented in the team. Unlike racio-ethnic and age diversity, which may create dysfunctional emotional conflict within teams, differences in the functional backgrounds of members should lead to beneficial effects on team performance, as diverse points of view should spur more creative outputs (Gebert et al., 2006). This may come at the cost of efficiency because of the multiplicity of perspectives within a team. Teams that develop a unique identity, within which members trust each other, are capable of leveraging the beneficial effects of functional diversity (Van Der Vegt and Bunderson, 2005). Consis-

Table 1. Summary of Literature Review and Hypotheses

Independent Variable	Key Findings[a]	Illustrative Studies	Hypothesis[b]
1. Team tenure	Positively related to performance; frequent membership changes decrease NPD performance	Gibson and Gibbs (2006); Akgun and Lynn (2002b)	H1: +
2. Functional diversity	Spurs innovation but may create emotional conflict; may decrease team efficiency; mixed results	Gebert et al. (2006); Keller (2001)	H2: No effect
3. Team ability	Cognitive ability predicts team performance; team experience improves speed to market	Devine and Philips (2001)[d]; Carbonell and Rodriguez (2006)	H3: +
4. Team leadership	Positive effect of participative and transformational leadership on team performance	Burke et al. (2006)[d]; Sarin and McDermott (2003)	H4: +
5. Internal communication	Helps develop shared meanings, clarify goals and roles, and foster creativity	Keller (1986); Lovelace, Shapiro, and Weingart (2001)	H5: +
6. External communication	Boundary spanning helps team performance by leveraging external resources	Ancona and Caldwell (1992a); Marrone, Tesluk, and Carson (2007)	H6: +
7. Group cohesiveness	Fosters effectiveness and efficiency when workflow patterns are interdependent, such as in NPD	Beal, Cohen, Burke, and McLendon (2003)[d]; Hoegl and Gemuenden (2001)	H7: +
8. Goal clarity	Teams with specific and clear goals outperformed others	O'Leary-Kelly, Martocchio, and Frink (1994)[d]; Lynn, Skov, and Abel (1999)	H8: +
9. Team size[c]	Small teams lack resources; large teams have coordination costs; unrelated to team performance	Stewart (2006)[d]	—

[a] Summary of the findings in the literature.
[b] The hypotheses are summarized in this column.
[c] Used primarily as a control variable in team literature.
[d] Indicates meta-analytic studies.

tent with these expectations, Keller (2001) found that functional diversity positively affected the technical quality of the new products, but had a negative impact on budget performance. In a meta-analysis of the effects of task-related diversity on team performance, Webber and Donahue (2001) found that team diversity had no effect on team performance. Hence, it is hypothesized that:

H2: Functional diversity is unrelated to NPD outcomes.

Team ability is defined as having the skills to deal with complex NPD projects including general intelligence and previous team experience. In a meta-analysis of the effects of cognitive ability on team performance, Devine and Philips (2001) found that higher average cognitive ability scores resulted in higher team performance. NPD literature reveals that team ability is a consistent predictor of NPD project success. For example, Carbonell and Rodriguez (2006) found that team experience was a positive predictor of speed to market. Hence, it is hypothesized that:

H3: Team ability is positively related to NPD outcomes.

Team leadership is defined as the extent to which the team leader is charismatic and transformational, and utilizes a style characterized as being participative, empowering, facilitative, and communicative. A team leader who is receptive to the ideas, needs, and wants of his/her team members is more likely to have highly motivated, conscientious people working to achieve the team's objective (Bass, 1985; Jassawalla and Sashittal, 2000; Lowe, Kroeck, and Sivasubramaniam, 1996). In a meta-analysis of team leadership, Burke et al. (2006) found that person-focused leadership behaviors (transformational leadership, consideration, and empowerment) accounted for a substantial percentage of the variance in team productivity. In the NPD context, Sarin and McDermott (2003) found that both considerate and participative leadership styles were positively related to NPD success. Hence, it is hypothesized that:

H4: Team leadership has a significant positive impact on NPD outcomes.

Team Process Variables

Four process variables describe how teams interact and accomplish their tasks: internal communication, external communication, group cohesiveness, and goal clarity.

Internal communication is the frequency and openness of information exchange among team members, which will lead to higher levels of group cohesion and greater clarity of their roles, thus leading to superior performance (Keller, 1986). Internal communication can lead to the development of shared meanings, particularly clarifying project goals. The more comfortable the team members feel communicating with each other, the better their new product performance (Brown and Eisenhardt, 1995; Lynn and Akgun, 2003). Hence, it is hypothesized that:

H5: Internal communication is positively related to NPD outcomes.

External communication is the degree of information exchange with people outside the team, in other areas of the organization, or outside the organization. Communication, particularly with customers, is a critical activity that helps build brand relationships (Duncan and Moriarty, 1998). Boundary spanning activities have been found to improve the performance of teams (Marrone, Tesluk, and Carson, 2007). An NPD team's speed-to-market performance is improved when they take advantage of external resources (Kessler and Chakrabarti, 1996). The more the team members are able to communicate with key people outside their team, the more effective they can be (Ancona and Caldwell, 1992a). Hence, it is hypothesized that:

H6: External communication is positively related to NPD outcomes.

Group cohesiveness is the extent to which group members feel a strong personal bond with each other (*esprit de corps*). Beal, Cohen, Burke, and McLendon (2003), in their meta-analysis, found that group cohesion was positively related to both organizational effectiveness and efficiency. Cohesive groups are more effective when workflow patterns are interdependent and intense (Beal et al., 2003), as in the case of NPD teams. Hoegl and Gemuenden (2001) found that group cohesion was positively related to both NPD effectiveness and efficiency. Hence, it is hypothesized that:

H7: Group cohesiveness is positively related to NPD outcomes.

Goal clarity is measured by the level of goal consensus within the NPD team. There is considerable evidence that clarity of organizational goals contributes to employee motivation. In particular, specific and challenging goals have been shown to be far superior to ambiguous and/or easy goals (Locke and Latham, 2002). In their meta-analysis of the effects of group goals on group performance, O'Leary-Kelly, Martocchio, and Frink (1994) found that groups with specific goals outperformed those without. Marks et al. (2001) suggest that when teams engage in mission analysis, they develop a shared vision

of the team's purpose and objectives, thus achieving greater clarity of team goals. Gersick (1988) found that when team members did not attempt to develop a shared understanding of the team's purpose, they risked becoming ineffective. Lynn, Skov, and Abel (1999) found that NPD project goal clarity was positively related to NPD success and speed to market. Hence, it is hypothesized that:

H8: Goal clarity is positively associated with NPD outcomes.

Moderators of Team Performance

NPD outcomes. Three types of outcomes are commonly studied in the NPD literature: NPD effectiveness, NPD efficiency, and speed to market (Keller, 2006; Mallick and Schroeder, 2005). NPD effectiveness is the extent to which the new product is successful by some external criteria; these could include market performance, quality, and the level of innovativeness. NPD efficiency measures the extent to which the NPD project adheres to budgets and schedules. Finally, speed to market measures the time taken by the NPD team to bring the product to market (commercialization). The effects of different input and process variables are likely to be moderated by the type of NPD outcome measured.

Rating source. Since NPD researchers rely on cross-sectional data gathered from team members and managers, whether the rating source moderated the effects of the predictors on NPD outcomes was examined. Ratings on team input and team process variables were collected from team members, excepting for information on team size, functional diversity, and team tenure, when tenure was measured as the time the team has been together. However, ratings on NPD outcomes were gathered from multiple sources including team members, team leaders, project managers, and customers. Differences in the observed relationships were examined when ratings were provided by team members (self) versus team leaders and/or NPD managers (other).

Measurement differences. Researchers often operationalize constructs differently; hence the effects of these differences on the observed relationships between the predictors and NPD outcomes were examined.

An Integrated Model of Team Performance

Since meta-analytic procedures only yield effects related to bivariate relationships, in the second phase of this study, the findings from the meta-analytic study were extended to test an integrated model of team performance (see Figure 1). Information was not available on all possible pairs of correlations, so the original list of nine independent variables was reduced to the seven predictors identified in italics in Figure 1. This partial test of the NPD team performance model allows estimation of the unique effects of each predictor, when all other predictors are present in the estimation model, and provides information of greater utility to NPD researchers and managers.

Consistent with the predictions of contemporary models of team performance (cf., Ilgen et al., 2005), it is expected that the effects of antecedents (team input variables) on NPD outcomes will be mediated by team process variables. Of the process variables, internal and external communication influence group cohesiveness, an emergent state. Following Marks et al. (2001), group cohesiveness is expected to partially mediate the effects of team inputs and the communication variables on NPD outcomes. As such, it is hypothesized that:

H9: Team process variables mediate the effects of team inputs on NPD outcomes.

H10: Group cohesiveness mediates the effects of other team process variables on NPD outcomes.

Methodology

Identification of Studies and Coding

Major research databases (including ProQuest, PsychInfo, etc.) were used to identify articles that focused on NPD and teams. Tables of contents from 1985 through 2009 of all major journals, including *Academy of Management Journal*, *Journal of Marketing, Journal of Marketing Research, Journal of Product Innovation Management*, and *Journal of Applied Psychology*, were searched to identify publications not found using the research databases. The references of every article identified earlier were searched to develop an extensive list of publications dealing with new product development and teams. To be included in this review, the study should have: (1) focused on new product development, (2) identified the NPD project as the unit of analysis, (3) included one or more NPD team-level variables as predictors, and (4) included one or more NPD project outcomes as the criterion variable. Thirty-eight studies met the criteria for inclusion in the meta-analysis (see Appendix A).

The coding of articles, particularly the study characteristics (moderators) and the independent variables, is a

subjective task, so each study was first coded by a trained graduate student, and then independently coded by the study's authors as a team. Differences between coding by the graduate students and the team of authors were resolved by reviewing the study for coding errors. The coding by the team of authors was retained when there were differences in subjective judgments. Consistent with previous meta-analyses that have dealt with multiple measures for similar constructs (Colquitt, Scott, and LePine, 2007; Song, Podoynitsyna, van der Bij, and Halman, 2008; Stewart, 2006), the definition and item composition of each of the measures identified in the first stage of coding was reviewed and recategorized into the eight independent variables described earlier. In each case, the study was reviewed for more information on scale definition and the individual items that comprised the scale before being categorized into one of the independent variables. For example, team tenure has been labeled as team stability (Akgun and Lynn, 2002a), team longevity (Sethi, 2000a), or group tenure (Keller, 2001). A typical study in this meta-analysis included just one or two of the eight independent variables examined here. Just one study (Keller, 2001) examined the effect of as many as five of the eight variables.

Each study was coded for several potential moderators, based on expected differences in the effects of team-level variables on NPD outcomes. These included: type of NPD outcomes—whether effectiveness, efficiency, or speed to market; source of outcome ratings—whether manager/team leader, or team members; and operationalization of the construct—single versus multiple item, for instance.

Meta-analysis Procedure

The Hunter and Schmidt (2004) procedure was used to aggregate the effects across studies and adjust for potential artifacts including sampling and measurement error. Zero-order correlation coefficients reported in each study were used along with sample size and predictor and criterion reliability as inputs in the estimation algorithms. Where reliability information was not provided, the weighted mean reliability based on all reported studies was used to substitute for the missing values. Following Hunter and Schmidt (2004), when a study reported multiple correlations for the same independent variable (for example, team tenure with NPD effectiveness rated by both project managers and team members), the average of these correlations was utilized in the meta-analysis. This ensured that the total sample size was not artificially inflated by double or triple counting the contributions of individual studies. Following Whitener's (1990) suggestion, the 95% credibility interval for each variable was estimated. The fail-safe K was also computed using the procedure suggested by Rosenthal (1979) to account for a possible file-drawer problem.

Path Analysis Procedure

In the second phase, for the nine independent variables, pair-wise correlations for all possible pairs were estimated. At least four possible strategies exist for dealing with missing information in the inter-item correlation matrix: (1) estimate the pair-wise correlation by conducting a new study or using studies from related areas including prior meta-analyses, (2) estimate the missing correlations by assigning average values from all other cells, (3) use expert judgment to assign a value to missing pair-wise correlations, or (4) delete missing rows/columns to identify a subset of variables for which complete information is available (Viswesvaran and Ones, 1995). The most conservative fourth strategy was chosen, thus, eliminating variables that had missing values. Two independent variables—team ability and goal clarity, were dropped leaving seven independent variables from the original list of nine. Since speed to market was not included in many of the studies, only NPD effectiveness and NPD efficiency were included as outcome variables in the integrated model. Since each correlation was estimated from a different number of studies (and hence different sample sizes), the harmonic mean of sample sizes across all cells was used as the sample size for all path analytic estimations, following Viswesvaran and Ones (1995). AMOS 18.0 (part of SPSS 18.0 package; IBM, Somers, NY) and the maximum likelihood estimation procedure was used to estimate the path coefficients. The procedure described by Jöreskog and Sörbom (1989) to correct for measurement error was used to specify the latent variable causal model. Specifically, factor loadings were set equal to the square root of the reliability of each scale score, and corresponding error variance values were fixed to be equal to one minus the scale reliability.

Since many of the aggregated effects were moderated by methodological artifacts, a baseline model using overall means was computed and compared to alternate models using minimum and maximum values of pair-wise correlations to reflect the effects of moderators.[1] The partially mediated model (shown in Figure 1), as well as several variations of completely mediated models, was

[1] One of the reviewers suggested this procedure to examine the robustness of the reported results.

tested to identify the unique effects of each team-level variable on NPD outcomes.

Meta-analysis Results

The effect size for the overall NPD outcomes for each of the nine independent variables, including team size, was estimated. The significance of the effect sizes was determined by the noninclusion of "0" in the 95% confidence interval. Corrected effect sizes less than .10 (explaining less than 1% of the variance in the criterion) were not considered as evidence in support of the hypotheses. The presence of potential moderators was examined by estimating the proportion of variance that remained unexplained. Hunter and Schmidt (2004) suggest a threshold value of 25% for unexplained variance; values exceeding the threshold indicate the presence of potential moderators. The results of the analyses are summarized in Tables 2 and 3. Results for each of the three types of NPD outcomes—effectiveness, efficiency, and speed to market are presented when at least three studies were available. The reported fail-safe *K* provides an estimate of the number of studies with null results needed to make the reported effects insignificant. A value of zero for fail-safe *K* indicates that the construct has an insignificant effect on NPD outcomes, and values larger than the number of studies included in the meta-analysis suggest that the observed results are stable. Large values of fail-safe *K* reported in Tables 2 and 3 indicate that the results are robust and unlikely to be affected by the file-drawer problem.

Team Input Variables

The effects of five different team input variables on NPD outcomes are summarized in Table 2 in order of effect size. Team leadership had the greatest impact on all three types of NPD outcomes followed by team ability and team tenure.

Team leadership. Hypothesis 4, that team leadership is positively related to NPD outcomes, is supported. The overall corrected effect size was .44; however, the high proportion of variance unexplained (78%) suggests the presence of moderators. The type of outcome moderated the effect of leadership on NPD outcomes. The effect sizes for NPD efficiency ($r_c = .33$, $n = 218$) and speed to market ($r_c = .30$, $n = 311$) were significantly less than the effect size for NPD effectiveness ($r_c = .44$, $n = 840$). Credibility intervals suggest the absence of any additional moderators regarding NPD efficiency and speed to market. However, the high percentage of unexplained variance in the correlations with NPD effectiveness (83%) suggests the presence of additional moderators. Two potential moderators were tested: rater source (team members versus managers) and type of team leadership (transformational versus other styles). The effects of rater source were tested by removing one study with same-source data. There was no difference in the estimates of the effect sizes reported in Table 2. However, significant differences were found in the effect sizes for the transformational/charismatic leadership style versus all other leadership styles (such as participative, empowering, or facilitative). The results of these additional moderator analyses are summarized in Figure 2. The cumulative impact of other leadership styles on NPD effectiveness, corrected for sampling and measurement errors, was .30 ($n = 550$), significantly less than the effect of transformational team leadership on NPD effectiveness ($r_c = .66$, $n = 303$). This is consistent with meta-analyses of the effects of transformational leadership on performance (Burke et al., 2006; Lowe et al., 1996).

Team ability. Hypothesis 3, that team ability has a positive impact on NPD outcomes, is strongly supported. The percentage of unexplained variance was almost zero suggesting the absence of any moderators. Team ability had a marginally greater impact on NPD effectiveness ($r_c = .27$, $n = 644$, Table 2) and speed to market ($r_c = .33$, $n = 657$) than on NPD efficiency ($r_c = .17$, $n = 407$). Removing one same-source study did not have any effect on the estimates, indicating that team ability has a robust effect on NPD outcomes irrespective of how the outcome is measured or who rated the outcomes.

Team tenure. The effect of team tenure on overall NPD outcomes was .28 ($p < .001$) providing strong support for H1. However, the large proportion of unexplained variance (78%) and the wide credibility interval suggested the presence of moderators. Team tenure was strongly related to speed to market ($r_c = .46$, $n = 1098$), but moderately related to NPD efficiency ($r_c = .12$, $n = 242$), and NPD effectiveness ($r_c = .15$, $n = 1073$). The wide credibility interval for NPD effectiveness indicated presence of additional moderators. Regarding NPD effectiveness, while the source of outcome data did not result in any change in the estimate ($r_{other} = .12$), there was a significant difference in the estimate of the effect size when team tenure was measured using a single item (i.e., number of months) versus a multi-item perceptual measure. The average effect size when tenure was measured as a single item was insignificant ($r_{single\text{-}item} = .02$, $n = 511$), whereas the effect

Table 2. Meta-Analysis Results—Team Input Variables

Independent Variables[a]	Number of Studies	Number of Teams	Number of Correlation Coefficients[b]	Range of r (Lo, Hi)	r (Weighted Mean)	r_c (Corrected)[c]	% Unexplained Variance[d]	95% Credibility Interval[e]	95% Confidence Interval[f]	Fail-safe K[g]
Team leadership	11	875	32	.07,.84	.37	.44**	78	.01, .87	.32,.56	476
– NPD effectiveness	10	840	20	.07,.84	.37	.44**	83	−.06, .94	.30,.58	415
– NPD efficiency	3	218	7	.20,.39	.26	.33**	0	–	.28,.38	13
– Speed to market	4	311	5	.19,.45	.25	.30**	0	–	.22,.38	25
Team ability	10	1,255	17	.08,.42	.23	.29**	0	–	.24,.34	235
– NPD effectiveness	7	644	8	.12,.42	.22	.27**	0	–	.20,.33	74
– NPD efficiency	4	407	5	.08,.21	.13	.17**	0	–	.13,.21	6
– Speed to market	4	657	4	.11,.32	.26	.33**	2	.30, .35	.26,.40	62
Team tenure	13	1,684	27	−.40,.44	.23	.28**	78	−.10, .67	.19,.38	415
– NPD effectiveness	10	1,073	14	−.40,.41	.12	.15*	60	−.13, .44	.06,.25	47
– NPD efficiency	4	242	8	−.16,.25	.10	.12*	0	–	.03,.22	0
– Speed to market	5	1,098	5	.24,.44	.36	.46**	34	.36, .57	.40,.53	258
Functional diversity	12	1,290	22	−.32,.37	.02	.02	53	−.22, .25	−.06,.10	0
– NPD effectiveness	7	622	12	−.27,.37	.10	.12	71	−.27, .50	−.03,.27	0
– NPD efficiency	4	225	6	−.24,.30	−.04	−.05	0	–	−.14,.05	0
– Speed to market	4	577	4	−.32, 16	−.06	−.07	60	−.30, .16	−.20,.06	0
Team size	15	1,390	40	−.30,.22	.01	.01	0	–	−.04,.05	0
– NPD effectiveness	14	1,207	20	−.30,.13	.04	.04*	0	–	.00,.08	0
– NPD efficiency	8	624	13	−.26,.22	−.02	−.02	0	–	−.09,.05	0
– Speed to market	6	733	7	−.20,.21	.01	.02	59	−.23, .26	−.10,.13	0

[a] Overall correlations (across all three types of NPD outcomes) reported in the first row for each independent variable.
[b] Whenever multiple correlations were reported (due to different indicators or sources of criterion ratings), the average correlation was used in the meta-analysis.
[c] Effect size corrected for both criterion and predictor reliability; *$p < .05$; **$p < .01$.
[d] Percentage of variance in the observed correlations that remains unexplained after accounting for sampling error; values higher than 25% indicate the possible presence of a moderator (Hunter and Schmidt, 2004).
[e] Credibility intervals (CI) based on SD_ρ (Whitener, 1990); blank values indicate negative error variance confirming that all observed variations are due to sampling and measurement error and not any moderator (see, Hunter and Schmidt, p. 89).
[f] Confidence intervals around error- and reliability-corrected correlation; inclusion of zero ("0") in the interval indicates lack of significance at the $p < .05$ level.
[g] Fail-safe K to address the file-drawer problem computed using the procedure suggested by Rosenthal (1979).

Table 3. Meta-Analysis Results—Team Process Variables

Independent Variables	Number of Studies	Number of Teams	Number of Correlation Coefficients	Range of *r* (Lo, Hi)	*r* (Weighted Mean)	r_c (Corrected)	% Unexplained Variance	95% Credibility Interval	95% Confidence Interval	Fail-safe *K*
Internal communication	9	806	23	−.27,.54	.27	.31**	34	.15, .47	.23,.39	186
– NPD effectiveness	9	806	15	.08,.54	.29	.33**	25	.20, .46	.26,.40	216
– NPD efficiency	4	385	7	−.27,.36	.16	.19*	58	−.08, .45	.03,.34	11
External communication	8	625	22	−.48,.41	.15	.18**	0	–	.12,.24	34
– NPD effectiveness	8	625	15	−.48,.41	.16	.19**	6	.13, .26	.11,.27	39
– NPD efficiency	5	331	7	.04,.38	.18	.23**	0	–	.12,.33	15
Group cohesiveness	8	633	29	.02,.89	.21	.25**	34	.07, .42	.16,.34	75
– NPD effectiveness	8	633	16	.05,.89	.27	.31**	75	−.11, .73	.16,.45	128
– NPD efficiency	6	399	12	.02,.72	.25	.29**	62	−.05, .63	.14,.44	49
Goal clarity	9	1,254	18	.10,.65	.39	.46**	52	.28, .63	.39,.53	625
– NPD effectiveness	7	813	12	.12,.63	.44	.50**	0	–	.44,.55	400
– NPD efficiency	3	221	3	.10,.65	.28	.34**	69	−.03, .72	.13,.56	16
– Speed to market	3	848	3	.24,.40	.38	.45**	0	–	.40,.51	133

* $p < .05$; ** $p < .01$.

size of the perceptual measure was much larger and significant ($r_{perceptual} = .27$, $n = 562$).

Functional diversity. Functional diversity was not significantly related to overall NPD outcomes, supporting H2. The wide credibility interval suggested the presence of moderators. Functional diversity had no effect on any of the three types of outcomes. Results suggested additional moderators for NPD effectiveness and speed to market. Additional moderator analysis for speed to market could not be conducted due to an insufficient number of studies. While the average corrected effect size for NPD effectiveness was .12 (see Table 2), this appears to be moderated by rater level and the method of measuring functional diversity. Outcome ratings provided by superiors (including team leaders) yielded the corrected effect size of .17 ($n = 487$). Due to an insufficient number of studies to compute the coefficient, comparison with self-ratings was not possible. However, the difference between the average effect (.12) and the effect with supervisor ratings (.17) suggests that rater level is a potential moderator. The effect sizes were also compared for studies that used the Blau (1977) or the Teachman (1980) index to compute functional diversity, with studies that had used a simple count of the different functions present or a multi-item survey measure of functional diversity. The mean effect size for studies using the Blau/Teachman index was .07 ($n = 182$), whereas the effect size for studies using a simple count or a multi-item measure was .16 ($n = 347$, $p < .05$). Clearly, the way functional diversity was measured had an effect on the size of the correlation reported. The results are identical to the one reported by Webber and Donahue (2001) for overall performance.

Team Process Variables

The effects of four different team process variables on NPD outcomes are summarized in Table 3 separately for team processes, the emergent state, and the proximal outcome. Goal clarity had the greatest impact on NPD outcomes followed by internal communication, group cohesiveness, and external communication.

Internal communication. Internal communication was positively and significantly associated with NPD outcomes ($r_c = .31$, $n = 806$) supporting H5. Based on the wide credibility interval and percentage of unexplained variance (34%), additional moderator analyses were conducted. Both type of NPD outcomes and rater source moderated the effect of internal communication. The effect on NPD effectiveness ($r_c = .33$, $n = 806$) was significantly greater than the effect on NPD efficiency ($r_c = .19$, $n = 385$). Significant differences in effect sizes for NPD effectiveness were also found for rater source ($r_{mgr} = .27$, $n = 547$; $r_{self} = .42$, $n = 311$). The effect size for NPD efficiency did not change significantly after one same-source study was removed. The substantial effect sizes, even after controlling for rating source, suggest that the relationship between internal communication and NPD outcomes is robust.

External communication. External communication was a significant predictor of NPD outcomes ($r_c = .18$, $n = 625$) providing support for H6. External communication was significantly associated with both NPD effectiveness ($r_c = .19$, $n = 625$) and NPD efficiency ($r_c = .23$, $n = 331$). The percentage of variance unexplained was

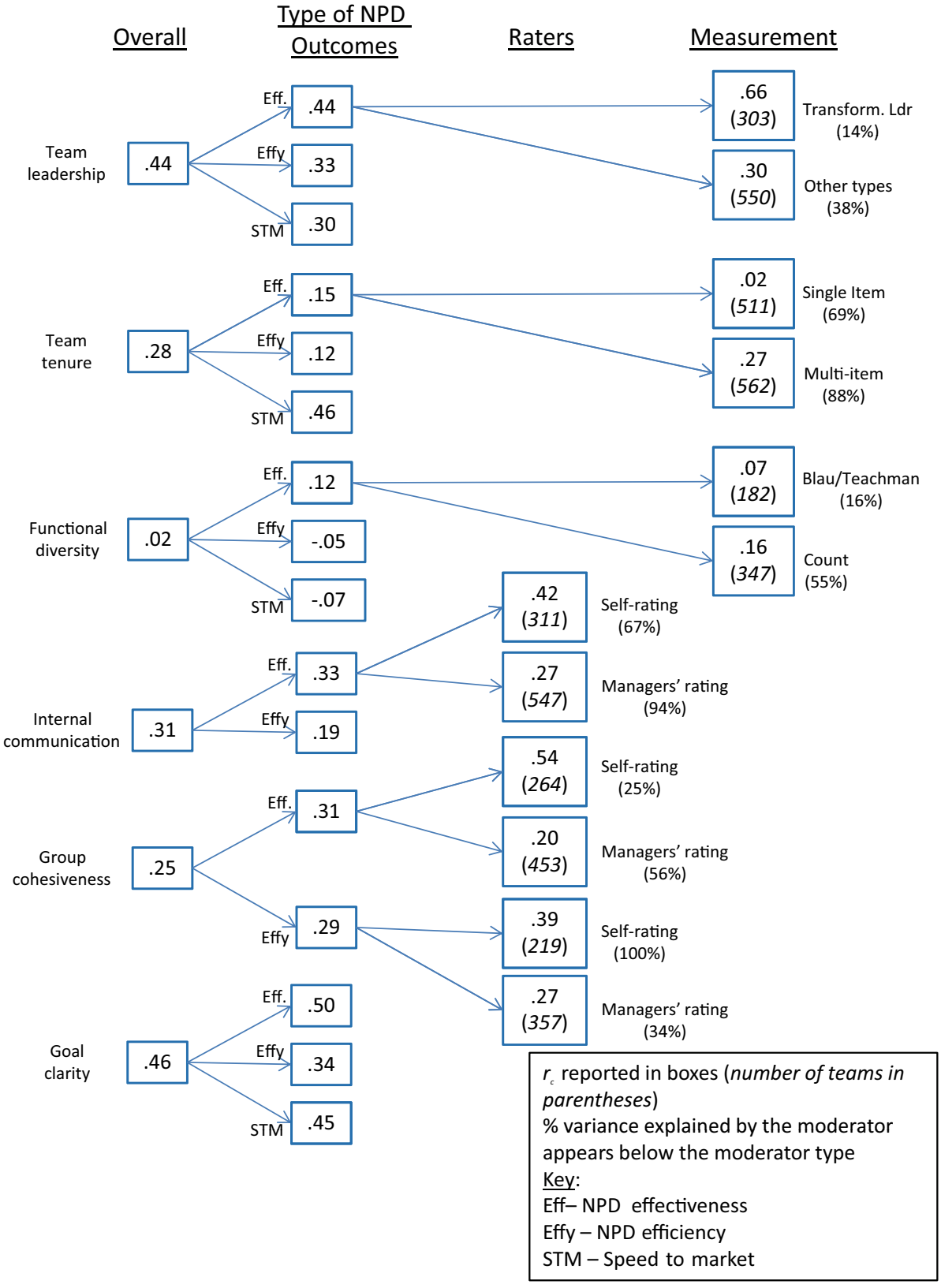

Figure 2. Summary of Moderator Analyses

either zero or almost zero, suggesting that the estimate is the true population correlation.

Group cohesiveness. H7, that group cohesiveness will be positively related to NPD outcomes, was strongly supported. However, the proportion of unexplained variance (34%) suggested the presence of moderators. Results reported in Table 3 indicate that type of NPD outcome did not moderate the observed effect size. The effect sizes for both NPD effectiveness and NPD efficiency were significant but not different from each other. While the mean corrected effect size is large, the wide credibility intervals and substantial unexplained variance suggest the presence of moderators. For NPD effectiveness, the effect sizes were estimated after controlling for rater source. The corrected effect size for same source data was significantly larger than the mean corrected effect size for manager's ratings ($r_{mgr} = .20$, $n = 453$; $r_{self} = .54$, $n = 264$), and in both cases, the credibility interval did not include zero. For NPD efficiency, the effect size for member ratings ($r_{self} = .39$, $n = 219$) was significantly larger than the effect size for manager ratings ($r_{mgr} = .27$, $n = 357$). Controlling for rater bias, the estimated effect size was positive and significant, confirming the importance of group cohesiveness to NPD outcomes.

Goal clarity. H8 stated that goal clarity is a significant predictor of NPD outcomes. As a proximal outcome of team processes (Marks et al., 2001), goal clarity was the best predictor of the NPD outcomes, supporting the hypothesis. The impact of project goal clarity was positive and consistent across the studies included in this review, particularly for NPD effectiveness and speed to market. The mean corrected effect size was .50 ($n = 813$) for NPD effectiveness and .45 ($n = 848$) for speed to market, and both were significantly greater than the effect size for NPD efficiency. While the mean effect size for NPD efficiency was large ($r_c = .34$, $n = 221$), the 95% credibility interval included "0" suggesting the presence of moderators, which were not tested due to an insufficient number of studies.

Summary of Moderator Analyses

Moderators were identified for six of the eight independent variables, and the results are summarized in Figure 2. The three moderators examined were the type of NPD outcomes, rater source, and the measurement of the independent variable.

Three of the team input variables—team leadership, team tenure, and functional diversity—were moderated by both type of NPD outcomes and how the independent variable was measured. Regarding team leadership, transformational leadership (i.e., measurement of the independent variable) had the greatest impact on NPD effectiveness (i.e., type of NPD outcome) as compared to participative leadership style and/or other NPD outcomes. When the measure was a multi-item measure of the team members' perceptions (e.g., our team has been together for a long time), as in the case of team tenure, or a simple count of the number of functions represented in the team, as in the case of functional diversity, the correlation with NPD effectiveness was fairly strong. However, when these variables were measured as a single item in the case of team tenure (e.g., number of months working together), or by the Blau or Teachman index in the case of functional diversity, the correlation with NPD effectiveness was not significant. Rater source was a moderator for internal communication and group cohesiveness. When the ratings of NPD effectiveness were provided by team members (self), the correlation with NPD effectiveness was significantly higher than when the ratings were provided by the team's leader or project manager (other).

Meta-analysis Conclusions

All eight hypotheses were fully supported. The meta-analysis results and the large values of fail-safe *K* confirm the criticality of team inputs and team process variables to NPD outcomes. Of the four team input variables, only functional diversity was not related to any of the outcomes. All four team process variables were positively correlated with NPD outcomes. There was no evidence of same-source bias in the estimated effect sizes, as controlling for rater source resulted in only a marginal reduction in the effect sizes. Observed relationships remained significant even after eliminating same source data, confirming the robustness of the findings.

Given that the effects of the team input variables are possibly mediated by the team process variables, the meta-analytic results are inconclusive about the impact of some of the team input variables on NPD outcomes. The path analysis model described in the following section attempts to resolve this question.

Path Analysis Results

A structural equation modeling approach was used to fit the model presented in Figure 1. The effect of the team input variables on NPD outcomes was hypothesized to be mediated by the team process variables. Among the team

Table 4 Path Analysis: Correlation Matrix

Correlations (Weighted Mean)	1	2	3	4	5	6	7	8
1. External communications								
2. Internal communications	.23							
3. Functional diversity	.41	−.05						
4. Group cohesiveness	−.20	.58	−.02					
5. Team size	.03	−.08	.17	−.05				
6. Team tenure	.06	.33	.04	.31	.06			
7. Team leadership	.13	.47	.01	.13	−.03	.10		
8. NPD effectiveness	.16	.29	.10	.26	.04	.12	.37	
9. NPD efficiency	.18	.16	−.04	.25	−.02	.10	.26	.48

$n = 312$ (harmonic mean across 36 cells); harmonic mean is the reciprocal of the simple mean of the reciprocal of each sample size.

process variables, group cohesiveness was hypothesized to mediate the effects of other process variables (internal and external communication) on NPD outcomes. The input matrix was the correlation matrix (see Table 4), and the path coefficients were estimated for different causal models using AMOS 18.0, all of which were nested within the partially mediated model described above. The overall mean correlations (reported in Table 4) were used instead of moderated effects as input to the path analysis. Path analytic results are summarized in Table 5.

Predicting Team Process Variables

Since it was hypothesized that team process variables will mediate the effects of team input variables on NPD outcomes (H9), the effects of the four team input variables (team size, team tenure, functional diversity, and team leadership) on internal communication and external communication were estimated. Two of the four variables were significantly associated with internal communication ($R^2 = .37$). The results suggest that as members stay together longer, their internal communication improves. A transformational and participative leadership style also promotes better internal communication. Functional diversity and team leadership were both related to external communication ($R^2 = .23$). As expected, the increased representation of multiple functions in the NPD team promotes better boundary spanning. Team leadership also contributed to enhanced external communication.

Group cohesiveness was positively affected by team tenure (longer tenures lead to greater cohesiveness), functional diversity (diverse teams are more cohesive), and internal communication (better communication within promotes higher levels of cohesiveness). External communication was negatively related to cohesiveness, suggesting that as team members maintain closer external

Table 5 Results of the Path Analytic Model Predicting Team Process and NPD Outcomes[a,b]

	Team Process Variables				NPD Outcomes			
			Cohesiveness		Effectiveness		Efficiency	
Predictors	Internal Communication	External Communication	Direct	Indirect	Direct	Indirect	Direct	Indirect
1. Team size	−.08	−.05	−.03	−.04	.06	−.03	.02	−.03
2. Team tenure	.32***	.05	.10*	.24***	−.01	.09*	.01	.07
3. Functional diversity	−.06	.45***	.26***	−.28***	−.11$^+$	.20***	−.40***	.35***
4. Team leadership	.47***	.14*	−.22***	.31***	.49***	−.08	.49***	−.20**
5. Internal communication			.82***		−.42***	.50***	−.82***	.73***
6. External communication			−.51***		.43***	−.31***	.73***	−.46***
7. Group cohesiveness					.61***		.89***	
R^2	.37	.23	.67		.34		.45	

$n = 312$.

[a] Standardized regression coefficients reported here.

[b] A bootstrap analysis (Monte Carlo simulation with 5000 samples of sample size 312) was conducted to estimate the bootstrap mean estimate and confidence interval for each of the coefficients reported above. The bootstrap results confirmed the results reported above. Detailed results of the bootstrap analysis are available from the authors upon request.

Two-tailed significance: $^+p < .10$; $*p < .05$; $**p < .01$; $***p < .001$.

ties, they may not develop close internal ties. Surprisingly, team leadership was negatively related to cohesiveness, suggesting that a participative and considerate leader may hinder group cohesion. Ordinary least squares regression of the input matrix yielded identical results. While the direct effect of team leadership was negative, the indirect effect (mediated by internal and external communication) was positive and significant ($\beta_{indirect}$ = .31, $p < .001$), suggesting that the relationship between team leadership and cohesiveness is more complex than indicated by the direct effect alone. Together, the six variables explained a significant portion of the variance in group cohesiveness ($R^2 = .67$).

Predicting NPD Outcomes

It was hypothesized that team process variables will mediate the effects of team inputs on NPD outcomes (H9), and that group cohesiveness will completely mediate the effects of internal and external communication on NPD outcomes (H10). The complete mediation model provided a significantly worse fit than the partially mediated model (as reported here). R^2 of the completely mediated models were about one half of the partially mediated models, thus providing only partial support for H9 and H10. The partial-mediation models predicting the two NPD outcomes were both significant. NPD effectiveness was predicted by team leadership, internal and external communication, and group cohesiveness ($R^2 = .34$). The results suggest that positive NPD outcomes are characterized by a transformational and participative leadership style, highly cohesive teams, and with considerable external communication. Internal communication had an unexpectedly significant negative relationship with NPD effectiveness. The indirect effects of internal communication, functional diversity, and team tenure were significant and in the predicted direction. However, the indirect effect of external communication was negative due to the negative direct effect of external communication on group cohesiveness.

NPD efficiency was predicted by all but team size and team tenure ($R^2 = .45$). Except for the surprising negative effect of internal communication, all other effects were in the anticipated direction. As expected, functional diversity was negatively related to efficiency. Highly diverse teams may require considerable time and effort to coordinate their activities, thereby negatively affecting NPD efficiency. Team leadership, external communication, and group cohesiveness were all positively related to NPD efficiency. A closer examination of the indirect effects provides additional insights into the relationships among these variables. Functional diversity had a positive indirect effect on NPD efficiency, counteracting its negative direct effects. A similar pattern was observed for internal communication, wherein the negative direct effects were offset by positive indirect effects.

Since many of the effects were moderated by methodological differences (as summarized in Figure 2), robustness of the findings were examined by estimating different path models based on the moderator analysis.[2] In the alternate models, the relationships between constructs were consistent with the baseline model, confirming the validity of the baseline findings.

Path Analysis Conclusions

The results summarized in Table 5, and described above, confirm the importance of team leadership, external communication, and group cohesiveness for NPD success. External communication can be improved by increasing the functional diversity of the teams and having a supportive leader that encourages team members to take risks. Group cohesiveness can be enhanced by keeping team membership the same, which promotes internal communication.

Discussion

Both research objectives were achieved: first, to identify a set of team-level variables that predict NPD outcomes and aggregate the findings across the 38 studies to provide estimates of the bivariate effect sizes for each team-level variable; and second, to extend the findings from phase one and estimate the unique effects of each team-level variable on NPD outcomes. The first eight (bivariate) hypotheses were supported using traditional meta-analytic methods. The last two hypotheses examined using path analysis were partially supported.

Barczak, Griffin, and Kahn (2009) identified factors deemed critical to success by NPD managers. They identified several team variables that differentiated "the best versus the rest," including project goal clarity, team leadership, cross-functional collaboration, and team expertise/ability. The meta-analysis results reinforce the criticality of these variables to NPD success and expand this list to include team communication and group cohesiveness.

[2] As suggested by one of the reviewers, two different models were estimated, one with the minimum values, and the other with the maximum values from the moderator analysis. Additional details on the procedures and complete results are available from the authors upon request.

The meta-analysis results reveal both the importance of different variables and the gaps in the literature. Seven of eight independent variables appear to have a substantial impact on NPD outcomes. Of the team input variables, transformational leaders have a powerful effect on their people, and hence on NPD outcomes. NPD teams with long tenure, considerable ability, and experience are able to bring new products to market faster. Of the process variables, goal clarity and internal communication had a very strong relationship with NPD outcomes, suggesting that improved internal communication and a shared understanding of project objectives are key to success. Group cohesiveness and external communication were also important predictors of NPD outcomes indicating the importance of *esprit de corps* within the team and boundary spanning across teams and organizations.

The path analysis revealed some unexpected results including the negative effects of team leadership on group cohesiveness. The inclusion of some of the omitted variables, such as team ability, could have provided additional insights into the observed relationship between team leadership and group cohesiveness. These variables might be substitutes for leadership (Kerr and Jermier, 1978) in that highly capable teams have less need for a strong leader in order to become a cohesive unit.

Group cohesiveness was hypothesized to mediate the effects of team process variables on NPD outcomes. The results suggest that group cohesiveness partially mediated the effects of external and internal communication on NPD effectiveness and NPD efficiency. Contrary to expectations, the observed total effect of internal communication on NPD efficiency was insignificant suggesting that the negative direct effects are offset by the positive indirect effects. Also, the total effect of internal communication on both NPD outcomes was significantly less than the effect sizes reported in Table 3. This suggests that there are other indirect effects that are not captured in the model due to the omission of key independent variables, such as goal clarity, which had a significant positive effect on both NPD outcomes (see Table 3). Both Atuahene-Gima (2003) and Pinto, Pinto, and Prescott (1993) report very high correlations between internal communication and goal clarity ($r = .67$ and .60, respectively) suggesting the possibility of the missing mediator in the model.

Limitations

Possible limitations of this study include: (1) the inability to draw causal inferences due to the cross-sectional nature of research studies; (2) the omission of correlational data in the research literature; (3) the restriction of the sample to journal publications; and (4) judgments made by the authors in classifying independent variables into one of the nine categories. Only published studies in refereed journals were included to ensure the highest academic integrity. The file-drawer problem was dealt with by reporting the fail-safe K values as additional evidence of the robustness of the findings. NPD researchers have used a wide variety of labels to identify their independent variables, so established practice (e.g., Colquitt et al., 2007; Stewart, 2006) was used to categorize them into the list of eight independent variables examined in this study. Including a broader array of independent variables in this meta-analysis was prevented by an insufficient number of studies assessing their impact on the NPD outcomes.

Because sample sizes varied from as few as 100 to over 1500 teams, the harmonic mean of sample size was used in the path analytic model. The models were computed with two different estimates of sample size (low and high) to examine the sensitivity of the findings to the sample size. The findings were not sensitive to sample size. A bootstrap analysis with 5000 samples also confirmed that the estimated effect sizes were robust.

Unlike the meta-analysis where effect size significance was established using the 95% confidence interval after correcting for artifacts, the path analysis utilized just the sample size to compute the significance of the correlations. Corrections for measurement error were made using the procedures suggested by Jöreskog and Sörbom (1989).

Implications for Future Research

Many of the studies in this review examined only one or two team-level variables. Researchers should expand the range of input and process variables examined in their studies to better understand the influence of these variables on NPD outcomes. The moderator analyses suggest that the operationalization of functional diversity and team tenure had a significant effect on the correlations with NPD outcomes, indicating the need to consider multiple measures of these two variables to minimize measurement bias. Three out of four team process variables in this study had not been related to speed to market. Given the importance of speed to market to business success, scholars should include this criterion in their future research. The mediated effects of other omitted variables such as goal clarity (an emergent state) on NPD outcomes also should be examined.

The dynamic taxonomy of team processes suggested by Marks et al. (2001) could not be fully tested in the path analysis. An emergent state outcome (group cohesiveness) was included but not a proximal outcome (goal clarity). Team processes that unfold over time should be incorporated to validate the taxonomy suggested by Marks et al. (2001). For example, Schaubroeck, Lam, and Cha (2007) found that team potency mediated the effects of team leadership on team performance. In this study, team leadership had a significant direct effect on both types of NPD outcomes, and inclusion of team potency in the model could result in greater clarity of the effects of leadership on team performance. More comprehensive modeling of the effects of internal and external communication on NPD outcomes is needed. While the meta-analysis results were supportive of the positive impacts of both types of communication on NPD outcomes, path-analytic results yielded only mixed support. Therefore, the effects of internal and external communication on NPD outcomes may not be as straightforward as modeled in this study. While group cohesiveness was significantly related to NPD effectiveness, the wide credibility interval suggests the presence of moderators. Apart from the type of criterion and rating source already examined in this study, additional moderators could include task characteristics (Beal et al., 2003) and team norms (Schacter, Ellertson, McBride, and Gregory, 1951). The influence of these moderators should be examined to better understand the role of group cohesiveness in NPD team performance.

Team-level variables that merit further consideration include team reward systems, collocation of team members, and team learning. Team learning assumes greater significance for NPD, as learning from one project may have significant spillover effects on future projects. Regarding project characteristics, project goal stability and top management support for the project are critical enablers of NPD success. Anecdotal evidence suggests that "goal creep" and lack of top management support can derail an NPD project. However, there were an insufficient number of published studies examining the influence of these variables on NPD performance to include them in this meta-analysis.

Implications for Managers

The modified I-P-O Model is a useful framework for managers to improve the performance of their NPD teams. This study found five independent variables that most impacted NPD outcomes: team leadership, team ability, external communication, goal clarity, and group cohesiveness. High-performing NPD teams were characterized by a transformational and empowering team leader; capable team members who are clear about their project goals are cohesive and communicate frequently outside the team.

The importance of the team leader to NPD success suggests management should carefully select a team leader who possesses a strong empowering, communicative, trustworthy, and transformational leadership style. Training and development interventions that foster such behaviors and strengthen the leadership competencies of the NPD team leader are needed. Team members should be selected for their cognitive ability and prior experience with new product development teams. The team leader can promote project goal clarity by encouraging team members to have open discussions to clarify how their mission, purpose, and new product value contribute to the strategic marketing plan objectives. The leader could also help the team create a norm of open and frequent communication among the team's members to achieve goal clarity by holding regular, ongoing meetings. Improved team communication through such interventions may result in greater role clarity leading to superior team performance (Salas, Rozell, Mullen, and Driskell, 1999).

Project managers should create work conditions whereby a team's members can develop a strong *esprit de corps*. Highly cohesive teams have lower transaction and coordination costs, resulting in improved adherence to project budget and timelines. High-performing organizations have accomplished this by team-building exercises, project leadership training, and support for cross-functional collaboration (Barczak et al., 2009). Moreover, maintaining team tenure positively impacts speed to market. Team membership should remain stable for a period of time as it takes time for a team to become high performing. Departing team members leave not just with their functional expertise but also the tacit knowledge about the processes and norms adopted by their team. New members have to learn these team-specific routines to function effectively, else affecting the team's ability to bring the new product to market faster.

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Appendix A

Details of the Studies Included in the Meta-Analysis

			Dependent			Independent										
Article	Number of Teams	DV Rater	Effec-tiveness	Efficiency	Speed to Market	Size	Tenure	Ability	Func. Diversity	Leadership	Internal Comm.	External Comm.	Cohesive	Goal Clarity	Country	Industry
Akgun and Lynn (2002a)	353	L			x		x	x						x	United States	Manufacturing
Akgun and Lynn (2002b)	400	L	x		x		x							x	United States	High tech
Akgun, Byrne, Keskin, Lynn, and Imamoglu (2005)	69	L	x		x	x	x	x							Turkey	Multiple
Akgun, Lynn, and Reilly (2002)	124	L	x					x							United States	Multiple
Ancona and Caldwell (1992a)	45	L,M	x	x								x	x		United States	High tech
Ancona and Caldwell (1992b)	47	L	x	x		x			x			x			United States	High tech
Atuahene-Gima (2003)	104	M	x	x		x					x	x		x	Hong Kong	High tech
Carbonell and Rodriguez (2006)	183	L			x	x	x	x	x						Spain	Multiple
Dayan and Di Benedetto (2009)	93	L	x		x	x	x		x		x		x		Turkey	Multiple
Dayan, Di Benedetto, and Colak (2009)	107	L	x		x	x				x					Turkey	Multiple
Eisenhardt and Tabrizi (1995)	72	A			x				x						Multiple	Computers
Faraj and Sproull (2000)	69	M	x	x				x							United States	Software
Fedor, Ghosh, Caldwell, Maurer, and Singhal (2003)	48	L	x							x					United States	Multiple
Hirst and Mann (2004)	22	L	x							x	x	x		x	United States	Multiple
Hoegl and Gemuenden (2001)	145	L,M	x	x							x		x		Germany	Software
Hoegl and Parboteeah (2006)	145	L	x	x		x		x							Germany	Software
Howell and Shea (2006)	41	L	x			x	x		x	x					United States	Manufacturing
Joshi and Sharma (2004)	165	L	x						x						Canada	Manufacturing
Keller (1986)	32	L,M	x	x		x	x						x		United States	NS
Keller (1992)	66	L,M	x	x						x					United States	NS
Keller (2001)	93	L	x	x		x	x		x		x	x	x		United States	Multiple
Keller (2006)	118	L,A	x	x	x	x		x		x					United States	Multiple
Kessler (2000)	75	L		x			x	x						x	United States	Multiple
Leenders, van Engelen, and Kratzer (2003)	44	L	x			x	x								United States	Electronics
Lovelace, Shapiro, and Weingart (2001)	43	L	x	x		x			x	x	x				United States	High tech
Lynn, Skov, and Abel (1999)	95	L	x		x									x	United States	Multiple
MacCormack, Verganti, and Iansiti (2001)	29	O	x					x							United States	Software
McDonough and Barczak (1991)	30	L,M			x					x					U.K.	High tech
Peters and Fletcher (2004)	42	L	x	x									x	x	U.K.	Software & consulting
Pinto, Pinto, and Prescott (1993)	62	M	x								x			x	United States	Healthcare
Pirola-Merlo, Hartel, Mann, and Hirst (2002)	54	L	x							x					Australia	Multiple
Sarin and McDermott (2003)	52	L,M	x		x	x			x	x					United States	High tech
Scott (1997)	42	M	x	x		x	x		x			x	x		United States	Manufacturing
Sethi (2000a)	118	L	x				x					x			United States	Cons. products
Sethi (2000b)	141	L	x						x		x				United States	Cons. products
Sethi and Nicholson (2001)	141	L	x				x					x			United States	Cons. products
Sethi, Smith, and Park (2001)	141	L	x						x	x			x		United States	Manufacturing
Thamhain (1990)	90	L	x					x			x			x	United States	High tech
TOTAL	3,740		33	14	11	15	13	10	12	11	9	8	8	9		

Notes:
DV, dependent variable; DV Rater: Criterion information provided by L—Project leader/Manager; M—Team member; A—Archival data; O—Customers/others; NS—Not specified.
Total number of studies indicated in the last row for each dependent/independent variable.