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CROSS-FUNCTIONAL PROJECT GROUPS IN RESEARCH AND NEW PRODUCT DEVELOPMENT: DIVERSITY, COMMUNICATIONS, JOB STRESS, AND OUTCOMES

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A model of cross-functional project groups was developed and hypotheses were tested in a study of 93 research and new product development groups from four companies. The results showed that functional diversity had indirect effects through external communication on one-year-later measures. Technical quality and schedule and budget performance improved, but group cohesiveness diminished. Functional diversity also had an indirect effect through job stress on group cohesiveness, which was again reduced. Implications for the development of conceptual models of cross-functional groups and their effective management are discussed.

Competitive forces have made the cross-functional project group or team the method of choice by which high-technology organizations generate and deploy new products and processes (Aldridge & Swamidass, 1996; Denison, Hart, & Kahn, 1996; Hauptman & Hirji, 1996). Cross-functional groups consist of members from different functional areas, such as various research disciplines (like chemistry, electronics, and metallurgy), engineering, manufacturing, or marketing. The cross-functional makeup provides the advantages of multiple sources of communication, information, and perspectives; contacts outside a particular project group; inclusion of downstream concerns in upstream design; a clearer line of sight to the customer; and speed to market, which is critical for success in globally competitive, high-technology markets. The upshot is better new product quality and shorter development times when cross-functional groups are used (Brown & Eisenhardt, 1995; Kessler & Chakrabarti, 1996). But the use of cross-functional groups can result in such negative outcomes as increased costs (AitSahlia, Johnson, & Will, 1995), felt stress, and lower group cohesiveness (Donnellon, 1996; Jehn, 1997; Swamidass & Aldridge, 1996). And although the use of cross-functional groups has proliferated in research and product development settings, Denison and colleagues (1996) noted that empirical research on the subject has lagged considerably.

Lawrence (1997), moreover, critiqued the model development and research on functional diversity (the mix of group members from different functional specialties) and other organizational demography variables as placing a "black box" between a demographic variable and outcomes. She argued that intervening subjective or process variables would add explanatory variance to theory about functional diversity and outcomes. Hence, in the present study I sought to answer two basic research questions that focused on theoretically plausible variables intervening between functional diversity and relevant outcomes, as suggested by Lawrence. First, do communications intervene between functional diversity and the outcomes of project group performance or cohesiveness in an important way? Second, does job stress intervene between functional diversity and the outcome of group cohesiveness? Neither of these important questions has been satisfactorily answered in the existing research, and they can be better examined by a longitudinal field study utilizing separate-source measures of performance.

CONCEPTUAL BACKGROUND AND HYPOTHESES

Recent work on cross-functional project groups in research and new product development settings has focused primarily on the roles of communications and costs in determining performance outcomes. Hauptman and Hirji (1996) studied 50 cross-national, cross-functional project teams and found there was more two-way communication among project members from different functional backgrounds (for instance, research and manufacturing) when such teams were used than when they were not used. Higher product quality, budget and

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schedule performance, and member satisfaction were also found with cross-functional teams. Hauptman and Hirji's cross-sectional, single-source research design, however, limits the inferences that can be drawn about the present research questions.

Ancona and Caldwell (1992) investigated 45 new product development groups from high-technology companies and used path analysis to study the mediating effect of external communications (from contacts outside a project group) and internal processes on both cross-sectional management ratings of technical innovation and budget and schedule performance. Tenure in the group and group size were also included in the study because of their presence in the prior literature on group dynamics. The results showed that functional diversity worked through external communications via contacts outside the project group to increase technical innovation and budget and schedule performance. Surprisingly, functional diversity had a direct, negative association with technical innovation. The authors suggested that functional diversity made teamwork among members of the group more difficult. Ancona and Caldwell's study resulted in demography-process-performance models that contributed to the conceptual basis of the present research, and it highlighted the importance of intervening variables such as communications for performance and teamwork outcomes.

Building on the work of Ancona and Caldwell (1992) and others, Denison and colleagues (1996) developed a diagnostic model of cross-functional groups and tested it with product development members of an automobile manufacturing organization, using factor analysis of the questionnaire and interviews. The results supported the model's inclusion of context variables (for instance, coordination with other teams), process variables (for instance, importance of work), and outcome variables (for instance, information creation). This study, however, only reported factor analysis results from individuals who were members of project groups, not results at the project-group level per se, and no tests of hypotheses. The authors suggested that future researchers should study the creation of information and its relationship with time performance, as well as how process variables influence outcomes in cross-functional groups. The latter was done in the present study.

A study of engineers in a research division of an electronics firm by Zenger and Lawrence (1989) focused on technical communications and found that age similarity among members was associated with increased communications inside project groups. For external communications, they found that employees similar in organizational tenure communicated more across the project group boundaries. The Zenger and Lawrence study, however, did not measure project performance—the focus of the present research questions. Pelled, Eisenhardt, and Xin (1999) studied 45 teams doing electronics process work and found functional diversity drove task conflict and that multiple types of diversity drove emotional conflict. Pelled and her colleagues used conflict as an intervening variable, but in the present study, I used communications and job stress as intervening variables to answer the research questions.

Olson, Walker, and Ruekert (1995) studied 45 new product development groups and found that functional diversity enhanced effectiveness and timeliness when the product being developed was new and innovative and the coordination mechanism was participative. Less innovative product development efforts did not benefit from the increased cross-functional exchange of ideas and information provided by functional diversity. These results are particularly interesting because the researchers took care to use separate-source project performance measures collected via management ratings, as opposed to perceptions of the project group members. Communications, however, were not directly measured or used as an intervening variable.

AitSahlia and colleagues (1995) used Markov chains to mathematically model (no empirical data were collected) the cost-time trade-off likely with use of concurrent engineering, a management technique for new product development that uses cross-functional groups to design in manufacturing and marketing factors in the early stages of a project. Their results suggest that the cross-functional aspect of concurrent engineering can enhance the speed to market of a new product but that downstream manufacturing and marketing costs tend to be "front-loaded" and incurred in the new product development phase. Because only a minority of new product development projects would get to the manufacturing and/or marketing phases, front-loading these downstream costs would result in net additional costs to the firm.

With their intelligent agent model of concurrent engineering, Tan, Hayes, and Shaw (1996) focused on the communication and information benefits of cross-functional downstream sources being included in upstream design cycles. (Again, no empirical data were collected in this study.) As Pelz and Andrews (1966) and Kessler and Chakrabarti (1996) noted, it is the creative tension produced by members from different functional areas working together that often can increase the speed by which new products get to market.

The findings from studies of cross-functional groups are generally consistent with the growing literature on diversity of all types in groups (that is, age, gender, ethnic background, education, as well as functional background). A consistent finding has been that, although diverse groups can have positive outcomes, their members also tend to have lower group cohesiveness and job satisfaction and higher turnover and job stressors than do members of homogeneous groups (Harrison, Price, & Bell, 1998; Jackson, Brett, Sessa, Cooper, Julin, & Peyronnin, 1991; Lau & Murnighan, 1998; Milliken & Martins, 1996). Demographic similarities among group members, moreover, tend to cue formation of interpersonal relations, trust, communications, and cohesiveness within the group (Tsui, Xin, & Egan, 1995).

Anecdotal evidence about the benefits of functional diversity tends to mirror the somewhat mixed picture of both positive and negative effects of cross-functional groups that has emerged from the empirical literature. R. A. Lutz, the president and chief operating officer of Chrysler Corporation, reported that cross-functional new product development groups produced better-quality products more quickly and at lower cost (Lutz, 1994). The key, he noted, is bringing together people from upstream and downstream functional areas so that they can communicate and bring coordinated knowledge to bear on a project. Reports from Chaudron (1995), Donnellon (1996), and Swamidass and Aldridge (1996), however, have indicated that cross-functional groups do not always work well. That is, members can be dissatisfied or distracted and may experience high job stress; agreement may be elusive; and conflicts and misunderstandings among functional departments may win out over cooperation, group cohesiveness, and consensus building.

Throughout the prior literature, the important roles of external and internal communications for the effectiveness and cohesiveness of cross-functional groups have been noted, as well as the likelihood of job stress resulting from cross-functional differences. Ancona and Caldwell's (1992) demography-process-performance models focus on the intervening role of communications, and other prior work (Jehn, 1997; Pelled et al., 1999) has pointed to the stressful effects of cross-functional differences that can act as mediators. This prior work was used to develop the conceptual model for the present study. In this model, I posit functional diversity as an antecedent variable; communication external to the group, communication internal to the group, and job stress as intervening variables; and technical quality, budget performance, schedule performance, and group cohesiveness as outcome variables. This model fits Lawrence's (1997) definition of a mixed theory, whereby a demographic variable and multiple outcomes require different intervening variables.

Three basic predictions were generated from the model. The first yields a set of hypotheses according to which functional diversity enables a project group to better tap sources of external communication and contacts, which provide more information, cognitive resources, and cross-fertilization of ideas and result in better technical quality, schedule performance, and budget performance (Ancona & Caldwell, 1992; Bantel & Jackson, 1989; Denison et al., 1996). External communication, however, can signal an identification or social relationship with those outside a group that can be detrimental to group cohesiveness (Denison et al., 1996; Harrison et al., 1998). Thus,

Hypothesis 1a. Functional diversity will have a positive indirect effect, through external communication, on technical quality.

Hypothesis 1b. Functional diversity will have a positive indirect effect, through external communication, on schedule performance.

Hypothesis 1c. Functional diversity will have a positive indirect effect, through external communication, on budget performance.

Hypothesis 1d. Functional diversity will have a negative indirect effect, through external communication, on group cohesiveness.

The second hypothesis set predicts that functional diversity makes internal communication among group members more difficult owing to differing functional goals, training, and orientations. The reduced internal communication in turn harms technical, schedule, and budget performance dimensions (Ancona & Caldwell, 1992; Zenger & Lawrence, 1989). Reduced communication among group members, moreover, can be harmful to internal social relationships and group cohesiveness (Harrison et al., 1998; Tsui et al., 1995). Therefore,

Hypothesis 2a. Functional diversity will have a negative indirect effect, through internal communication, on technical quality.

Hypothesis 2b. Functional diversity will have a negative indirect effect, through internal communication, on schedule performance.

Hypothesis 2c. Functional diversity will have a negative indirect effect, through internal communication, on budget performance.

Hypothesis 2d. Functional diversity will have a negative indirect effect, through internal communication, on group cohesiveness.

The third hypothesis predicts that functional diversity will increase job stress because of the expected difficulties in interactions and trust among members with different training, goals, and perceptions. Job stress would then reduce cohesiveness within the project group (Harrison et al., 1998; Milliken & Martins, 1996). Hence,

Hypothesis 3. Functional diversity will have a negative indirect effect, through job stress, on group cohesiveness.

METHODS

Participants

Ninety-three applied research and new product development groups from four companies engaged in the energy, chemicals, aerospace, and electronics industries comprised the sample. These industries allowed for the study of projects from a range of research and product development activities in various stages of the technological innovation process. The groups were made up of 646 professional participants for whom complete data at both time 1 and time 2 (one year later) were obtained. The response rate was 90 percent of those invited to participate at time 1, and 96 percent of those who participated at time 1 also participated at time 2. Eighty-four percent of the participants were men, and their average age was 34 years. (Data on national origin and race were not collected.) All the participants held baccalaureate degrees, and 73 percent held graduate degrees. During the one-year span of this study, each participant was a full-time member of only one project group. All project groups were still ongoing at the end of the study.

Measures

Functional diversity was measured by the diversity index recommended by Teachman (1980) and used by Ancona and Caldwell (1992):

$$H = -\sum_{i=1}^{s} P_i (\ln P_i).$$

Under this formula, the greater the distribution of project group members across different functional units, the higher the score would be for functional diversity. Membership in a functional area was determined by company organization charts or records. In this formula, H represents heterogeneity and P is the proportion of project group members from each functional area (such as chemistry, engineering, manufacturing, marketing, and so forth) (Ancona & Caldwell, 1992; Teachman, 1980).

External communication was measured by three items that asked about the amounts of task-related communication outside a project group but within the research or product development organization, outside the research or product development organization but within the company, and outside the company. *Internal communication* was measured by an item that about asked the amount of task-related communication within the project group. All items used a five-point response scale ranging from "very low" to "very high."

Job stress was measured by a four-item scale developed in previous research (Keller, 1984) with a five-point response scale ranging from "strongly disagree" to "strongly agree." (The items were "I experience tension from my job," "Aspects of my job are a source of frustration to me," "There is no strain from working in my job," and "I never feel pressured in my job.") *Group cohesiveness* was measured by Seashore's (1954) five-item scale on a five-point response scale ("very false" to "very true"; sample item: "I feel that I am really a part of my project group.") Confirmatory factor analysis of the four subjective measures above suggested that the four-factor model provided a good fit to the data ($\chi^2_{59} = 448.65$, $p < .01$, goodness-of-fit index [GFI] = .93, comparative fit index [CFI] = .90, root mean square error of approximation [RMSEA] = .06).

Project group performance was measured by management ratings of criteria developed through discussions with managers in the companies studied, and they were similar to criteria used internally by the companies. *Technical quality, schedule performance*, and *budget performance* were each rated on a five-point response scale ranging from "very low" to "very high." A panel consisting of three to six managers in each organization rated the project groups with which they were familiar, with each manager rating from 9 to 16 projects. These managers were one level above that of the project group leaders. Interrater reliabilities computed as intraclass correlation coefficients (ICCs[1, k]; Shrout & Fleiss, 1979) were .74, .73, and .71, respectively, for technical quality, schedule performance, and budget performance.

Tenure in the project group and *tenure in the company* were included as control variables because prior work has suggested that these variables have been related to interpersonal contacts, knowledge bases, and group performance (Carroll & Harrison, 1998; Harrison et al., 1998; Zenger & Lawrence, 1989). As Ancona and Caldwell (1992) suggested, the coefficient of variation (standard deviation divided by the mean) was used for the tenure variables. Actual *group size* was also included as a control because prior research has found it to be related to cohesiveness and internal communication for groups (Ancona & Caldwell, 1992; Bantel & Jackson, 1989). Coefficient alpha reliabilities are reported on the diagonal of the correlation matrix (Table 1).

Analysis

The outcome variables of technical quality, schedule performance, budget performance, and group cohesiveness were measured one year after functional diversity, job stress, external communication, internal communication, and the control variables of group tenure, company tenure, and group size. The one-year period allowed for the time lag needed to transform scientific and technological information into technological innovations and new products and for group interactions to result in cohesiveness (Bergh, 1993).

A one-way analysis of variance was conducted on each of the variables to determine whether between-group differences were more significant than within-group differences, in order to justify aggregation of data collected from individuals to the project group level (Chan, 1998). Also, I calculated a Bartlett-Box F to test for homogeneity of variance. All of the variables passed these tests beyond the .05 level of significance, except for job stress. (Fs for one-way analysis of variance tests for variables other than stress ranged from 2.16 to 8.71.) As James (1982) and George and James (1993) noted, however, aggregation may be appropriate even without statistical justification when the theory, research questions, and hypotheses of a study require a particular level of analysis. Hence, all variables were aggregated to project group means because the model, research questions, and hypotheses were focused on this level of analysis. (It is possible that had stress met the statistical requirements for aggregation, its aggregated relationships with other variables in this study might have been stronger.)

Data collection procedures were the same across the organizations and at both data points. From 30 to 60 participants at a time completed the questionnaire during normal business hours at their work sites. As the researcher, I was the only nonparticipant present, and the management of each company and I guaranteed the confidentiality of all information. Only summary information was reported back to the participating companies.

RESULTS

Means, standard deviations, and a correlation matrix of all variables are presented in Table 1. (Company differences were examined using the dummy variable coding procedures and analyses described in Cohen and Cohen [1983]). No consistent or explainable patterns of results could be attributed to company differences.)

According to Baron and Kenny (1986), three conditions should be satisfied before one can test for mediation. Namely, the independent and mediator variables must be correlated, the independent and dependent variables must be correlated, and the mediator and dependent variables must be correlated. Establishing mediation requires that the effect of an independent variable on a dependent variable be less when the mediator is included in a regression equation than it is when the mediator is not included. Table 2 reports regression results to

TABLE 1
Means, Standard Deviations, and Correlations[a]

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10
1. Functional diversity	0.44	0.35										
2. Internal communication	3.84	0.96	−.28**									
3. External communication	11.18	2.85	.45**	.10	(.80)							
4. Job stress	15.52	2.85	.40**	−.13	.20	(.85)						
5. Technical quality	3.18	0.89	.37**	.08	.34**	.19						
6. Budget performance	3.51	1.10	−.24*	.19	.13	.17	.02					
7. Schedule performance	3.06	0.80	.30**	.20	.37**	.21*	.14	.08				
8. Group cohesiveness	19.36	4.12	−.15	.43**	−.22*	−.30**	.13	.10	.14	(.79)		
9. Group tenure	0.40	0.17	.00	.22*	.01	−.18	−.02	.12	.25*	.27**		
10. Company tenure	0.59	0.38	.03	.16	.05	−.13	.01	.01	.12	.04	.37**	
11. Group size	8.07	4.61	.13	−.25*	.11	.15	.10	.02	−.06	−.24*	.16	.06

[a] n = 93 (project groups). Numbers in parentheses on the diagonal are coefficient alpha reliabilities. The coefficient of variation (standard deviation divided by the mean) was used for both tenure measures.

* $p < .05$

** $p < .01$

TABLE 2
Regression Results for Project Performance Variables and Cohesiveness[a]

Variable	Technical Quality		Budget Performance		Schedule Performance		Cohesiveness	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Group tenure	−.04 (0.59)	−.03 (0.53)	.13 (0.72)	.18 (0.68)	.27* (0.50)	.23 (0.47)	.34* (2.56)	.19 (2.31)
Company tenure	−.01 (0.26)	−.01 (0.23)	−.03 (0.32)	−.01 (0.29)	.02 (0.22)	.00 (0.20)	−.07 (1.13)	−.12 (0.99)
Group size	.07 (0.02)	.05 (0.02)	.03 (0.03)	−.01 (0.02)	−.15** (0.02)	−.10 (0.02)	−.28* (0.09)	−.11 (0.08)
Functional diversity	.25* (0.26)	−.03 (0.29)	−.24* (0.33)	−.55** (0.37)	.32** (0.22)	.17 (0.26)	−.11 (1.15)	.22 (1.27)
Internal communication		.05 (0.09)		.08 (0.12)		.28* (0.08)		.40** (0.40)
External communication		.56** (0.03)		.29* (0.04)		.24* (0.03)		−.27* (0.14)
Job stress		.09 (0.03)		.41** (0.04)		.18 (0.03)		−.34** (0.14)
F	1.65	5.98**	1.65	4.72**	4.50**	5.98**	4.50**	8.09**
R^2	.07	.33	.07	.28	.17	.33	.17	.40
Adjusted R^2		.28		.22		.28		.35

[a] $n = 93$ (project groups). Standardized coefficients are reported. Standard errors are in parentheses. For overall models, $df = 7, 85$. Group and company tenure were measured as coefficients of variation.

* $p < .05$

** $p < .01$

test mediation and the direct and indirect effects of functional diversity on the outcome variables. All regression equations included the control variables of group tenure, company tenure, and group size.

The results in Tables 1 and 2 suggest that the conditions for mediation were satisfied for external communication's relationship with technical quality and schedule performance but were not for internal communication's relationship with any performance variable. Because functional diversity was not correlated with group cohesiveness, the conditions for mediation were not totally satisfied. The general pattern of results, however, justified examining mediating effects by testing for the hypothesized direct and indirect effects of functional diversity on the outcome variables.

As can be seen in the full model results (model 2) in Table 2, functional diversity had little direct effect on technical quality but had a strong, positive indirect effect, through external communication, on technical quality. Hence, Hypothesis 1a was supported. Functional diversity did not have a direct effect on schedule performance, but it did have a positive indirect effect, through external communication, on schedule performance. Thus, Hypothesis 1b was supported. The results for budget performance show a negative direct effect for functional diversity, but a positive indirect path through external communication (better budget performance means lower costs), which supports Hypothesis 1c. Functional diversity did not have a direct effect on group cohesiveness, but there was an indirect negative effect through external communication on cohesiveness. Hence, Hypothesis 1d was supported.

The hypothesized indirect negative effects of functional diversity on performance, through internal communication, were not found; hence, Hypotheses 2a, 2b, and 2c were not supported. Internal communication, however, did have a direct positive effect on schedule performance. Functional diversity had a negative relationship with internal communication, but internal communication had a positive direct effect on group cohesiveness. Hence, Hypothesis 2d was not supported.

Table 2 shows that functional diversity had no direct effect on group cohesiveness. Functional diversity, however, had a positive effect on job stress, and it had an indirect negative effect, through job stress, on group cohesiveness. Hence, Hypothesis 3 was supported. It is also worthy of note that job stress had a positive direct effect on budget performance but that functional diversity had a negative direct effect on budget performance.

DISCUSSION

The results provide important evidence that cross-functional groups in research and new product development can deliver better technical quality, faster schedule performance, and better budget performance but primarily do so through the indirect effects of external communication. The key point is that functional diversity works its beneficial effects on project performance through increased external communication because the benefits are due to having members with diverse backgrounds and areas of expertise and diverse contacts with important external networks of information. By itself, functional diversity had no direct effect on technical quality, a rather strong, negative direct effect on budget performance, and no direct effect on meeting schedules. These results provide the theory-building, explanatory variance that Lawrence (1997) pointed out as missing in the literature that only looks at the black box of relationships between functional diversity and outcomes. The present results join other research (Ancona & Caldwell, 1992; Pelled et al., 1999) in pointing the way to the inclusion of critical intervening variables in conceptual models explaining the dynamics of performance in cross-functional groups.

The present results are also quite instructive in helping to explain why cross-functional project groups tend to have lower group cohesiveness than single-function groups. Again, as suggested by Lawrence (1997), the key is to include theoretically relevant intervening variables, which in this case were external and internal communications and job stress. Functional diversity had no direct effect on cohesiveness, but functional diversity did lead to increased job stress, and the indirect path through job stress resulted in lower cohesiveness. This dysfunctional effect results from stressful relationships among project group members who do not share the same education, training, functional goals, and cultural norms, but who have to work together, often under speed-to-market pressure. The toll can be felt in groups that lack cohesiveness and "social glue." Consistent with these results were the findings that external communication had a negative direct effect on cohesiveness, while internal communication had a positive direct effect on cohesiveness. External communication may signal an identification with outsiders, but internal communication can build relationships among group members.

It is interesting to note that the four outcome variables were not correlated with one another. Perhaps the factors that account for high technical quality, such as scientific and engineering proficiencies, are not related to the administrative factors that can more directly affect meeting budgets and schedules. Cohesiveness, moreover, may depend on social factors not tightly tied to those that account for project performance. Further, functional diversity had positive indirect effects on technical quality and schedule performance, but a negative direct relationship with budget performance. Because cross-functional projects tend to have higher net costs owing to front loading, budget performance would logically suffer. These results point out the complexity of cross-functional project groups and the need to separate out the effects of different intervening variables on multiple outcomes with a longitudinal research design.

The concomitant existence of both positive and negative effects of functional diversity are similar to what Pelz and Andrews (1966) and, more recently, Kessler and Chakrabarti (1996) identified as "creative tensions" in research and development environments that result in innovative outcomes. Pelz and Andrews suggested that scientists and engineers did effective work when they were under not-too-comfortable conditions. Rather, having multiple forces pulling in different directions stimulated creative thought and resulted in technical achievement. A cross-functional project group can provide just this sort of environment with the stresses and strains of different functional, educational, and cultural perspectives from members of upstream and downstream units, as well as the pressure for speed to market.

Normative implications for the management of research and new product development project groups can be drawn from the present findings. Cross-functional groups can be effective if they contain the proper mix of functions and people to enhance external communication. Opportunities for members to communicate with external sources should be provided within the project group, and information obtained should be disseminated to other members of the group. Project group managers should understand the potential for and, indeed, the likelihood of, job stress increasing owing to functional diversity and should try to moderate the effects on group cohesiveness through interventions if possible. Tsui and her colleagues (1995) suggested interventions to improve the quality of interpersonal relationships, such as training in active listening skills for group leaders and the exchange of expectations between group members and leaders. Walker and Hanson (1992), moreover, reported that dialogue groups at Digital Equipment Corporation helped members to examine stereotypes and build good relationships with others they regarded as different.

The present research provides a more rigorous investigation of cross-functional project groups than most of the existing literature because of the use of an a priori model with intervening variables, a sample of project groups from more than one organization, and separate-source performance measures; inclusion of project group tenure, company tenure, and group size as control variables; and lagging the measurement of the outcome variables one year to allow for longitudinal effects. Limitations, however, include the use of a potentially inappropriate time lag, given that all the outcome variables may not have had the same optimal period; same-source measurement of intervening and outcome variables for the job stress–cohesiveness relationship (although the one-year lag for cohesiveness may have reduced common method variance somewhat); the aggregation of job stress to the project-group level without statistical justification; and measurement of internal communication with a single-item measure of unknown reliability.

Future research should focus on what particular mix of functional backgrounds would be best for a particular task or set of outcomes, the identification of other intervening variables, such as conflict in a project group, finer-grained measures of communication, and use of different time lags between communication and project outcomes. The effectiveness of specific interventions, such as dialogue groups, in reducing dysfunctional effects is also worthy of additional research.

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