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TEAM STRUCTURE AND PERFORMANCE: ASSESSING THE MEDIATING ROLE OF INTRATEAM PROCESS AND THE MODERATING ROLE OF TASK TYPE

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We used data from 45 production teams (626 individuals) and their supervisors to test hypotheses related to team structure. For teams engaged primarily in conceptual tasks, interdependence exhibited a U-shaped relationship with team performance, whereas team self-leadership exhibited a positive, linear relationship with performance. For teams engaged primarily in behavioral tasks, we found a ∩-shaped relationship between interdependence and performance and a negative, linear relationship between team self-leadership and performance. Intrateam process mediation was found for relationships with interdependence but not for relationships with team self-leadership. Overall, findings support a model of team structure and illustrate how relationships between structural characteristics and a team's performance can be moderated by its tasks.

Teams are becoming a basic building block for many contemporary business organizations, with one survey finding 68 percent of *Fortune* 1000 companies using self-managing teams (Lawler, Mohrman, & Ledford, 1995). Most of these teams are directly involved with producing goods and services. Research has generally supported the efficacy of teams for improving worker satisfaction, but studies have been inconclusive concerning the effect of teams on productivity (Banker, Field, Schroeder, & Sinha, 1996; Cohen & Ledford, 1994; Stewart, Manz, & Sims, 1999). Several researchers have hypothesized that variation in team performance can be explained by differences in team structure (Cohen & Bailey, 1997; Gladstein, 1984; Hackman, 1987; Manz, 1992; Wageman, 1995). This study was thus designed to determine how team structure relates to team performance.

Organizational theorists have defined structure as the configuration of relationships with respect to the allocation of tasks, responsibilities, and authority (Greenberg & Baron, 1997; Jones, 1995). Team structure is thus defined here as team relationships that determine the allocation of tasks, responsibilities, and authority.

In their review of factors that correlate with team effectiveness, Campion, Medsker, and Higgs (1993) identified two important elements of team structure: interdependence and team autonomy/self-leadership. The importance of these two characteristics is supported by organization-level research that has identified concentration of authority and structuring of activities as the two primary categories of structure (Pugh, Hickson, & Turner, 1968; Pugh & Hickson, 1997). In their review, Cohen and Bailey (1997) also identified team autonomy and interdependence as the primary task design characteristics that influence team effectiveness through team interaction processes such as conflict and communication. Cummings (1978) also proposed group versus individual jobs (which parallels interdependence) and source of control (autonomy/self-leadership) as two fundamental features associated with team structure.

Although team self-leadership and interdependence have both received scholarly attention, inconsistent findings suggest a need to develop a deeper understanding of how these structural characteristics relate to team performance. We thus designed this study to go beyond previous studies (e.g., Campion et al., 1993; Campion, Papper, & Medsker, 1996; Saavedra, Earley, & Van Dyne, 1993; Wageman, 1995) by (1) focusing on mediating process variables to explain how team structure

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and performance are related and (2) exploring whether the team structure–performance relationship is consistent across tasks.

Almost every model developed to explain team performance (e.g., Cohen & Bailey, 1997; Gladstein, 1984; Goodman, Ravlin, & Argote, 1986; Guzzo & Shea, 1992; Hackman, 1987) is grounded in McGrath's (1984) input-process-output perspective. McGrath's basic proposition is that inputs such as structural characteristics combine to affect team processes, which in turn influence team outputs. Unfortunately, the input-process-output links proposed by prior researchers have received limited empirical attention. Gladstein (1984) found support for the input-process-output model when member satisfaction and team self-ratings of production were used as criterion measures, but not when external production ratings were used. Our study builds on these findings by further modeling the extent to which intrateam processes mediate the relationship between team structure and performance.

Prior research on small groups and teams (Goodman, 1986; McGrath, 1984) and sociotechnical systems (e.g., Trist, 1981) has suggested that task differences moderate the relationships between group inputs, processes, and outcomes. However, task differences have not been specifically assessed to determine whether task type moderates the relationship between team structural characteristics and team performance. Thus, the second specific contribution of this study is examination of the extent to which task differences moderate how interdependence and team self-leadership relate to team performance.

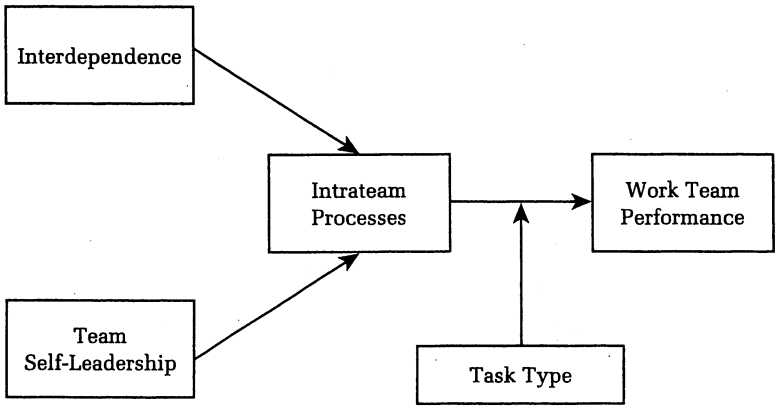
RELATING TEAM STRUCTURE AND TEAM PERFORMANCE

Figure 1 shows a model of the relationships expected between team structure and team performance. According to the model, which is based on both the input-process-output model and sociotechnical systems theory (Trist, 1981), team processes mediate relationships between team performance and the structural characteristics of interdependence and team self-leadership. Task type also moderates these relationships, as a team's tasks are expected to influence the link between team processes and performance. In the following sections, we first discuss the link between team processes and team performance and look at task type as a potential moderator of this relationship. We then offer predictions about how the structural characteristics of interdependence and team self-leadership relate to team processes and thereby to team performance.

Team Processes, Team Performance, and Team Tasks

Construct definition. Intrateam processes represent interactions that take place among team members (Hackman, 1987). Most measurements of intrateam process have been based on the work of Bales (1950) and include assessments of both task and socioemotional interactions (Gladstein, 1984; McGrath, 1984), Hackman defined the socioemotional category as "the interpersonal transactions that take place within the group: who is talking with whom (or not doing so), who is fighting with whom, who is pairing up with whom, and so on" (1987: 321). Hackman defined the task category as "those aspects of interaction that relate directly to a group's work on its task" and stated that "it should be possible, for example, to assess whether a group is using the energy and talents of its members well (rather than wasting or misapplying them), and to determine whether the group interaction develops

FIGURE 1
Team-Level Model of Work Design



and expands (rather than diminishes) members' performance capabilities" (1987: 321).

Numerous classification systems have been proposed to describe differences in the tasks performed by teams (e.g., Herold, 1978; McGrath, 1984; Shaw, 1973; Steiner, 1972; Tushman, 1979). Among these classification schemes, the approach taken by McGrath appears to be one of the most useful for classifying the tasks of teams operating in actual work environments (Goodman, 1986). McGrath's (1984) typology is developed around a "circumplex" that includes four task categories: generating ideas and plans, choosing between alternatives, negotiating conflicts of interest, and executing work. Along one dimension of the circumplex, tasks differ in the extent to which they are either behavioral or conceptual, with work execution tasks anchoring the behavioral end of the continuum.

However, one problem with task classification in actual work situations is that a team rarely performs only one type of task (Argote & McGrath, 1993; Goodman, 1986). In fact, McGrath (1984) suggested that teams perform tasks associated with all four of his categories, but with unequal frequency. This means that it may be inappropriate to classify the multidimensional tasks of actual work teams into mutually exclusive categories. An alternative, and often more appropriate, approach is to arrange the relative amounts of time each team spends on tasks along a continuum like the behavioral-conceptual dimension (Goodman, 1986).

The primary focus of a production team is work execution. However, because of differences in the length of production runs, variety of outputs, and stability of the environment, teams vary in the amount of time during which they actually execute behavioral tasks rather than plan, decide, and negotiate. Some production teams spend almost all of their time executing behavioral tasks—in McGrath's words, dealing with "overt, physical behavior, with the execution of manual and psychomotor tasks" (1984: 65). Other production teams, partly in response to having less clarity about which behavioral tasks are appropriate, spend a larger proportion of their time performing conceptual tasks that help them determine appropriate courses of action. The relative amount of time spent on behavioral tasks rather than on conceptual tasks like planning, deciding, and negotiating thus serves as a useful means of assessing the effects of task differences on production teams.

Hypothesized relationships. Empirical results (e.g., Barry & Stewart, 1997; Campion et al., 1993) generally support a positive, linear relationship with performance for synergistic processes (such as flexibility and open communication) and a negative, linear relationship for dysfunctional processes (such as shirking and conflict). However, the relationships exhibit substantial variation in their magnitude. Some studies have found almost no relationship between processes and performance (Gladstein, 1984), whereas others have yielded correlation coefficients exceeding .70 (Campion et al., 1996). This variability is consistent with the moderator effect shown in Figure 1, as task differences are expected to moderate process-performance relationships.

The work of production teams engaged predominantly in behavioral tasks is easily programmed, and information is centralized rather than diffused among team members (Goodman, 1986; Herold, 1978). Work requires little interaction, or interaction that is so mundane and nonproblematic that it does not create interpersonal difficulties (Herold, 1978). The ends and means of production are clear, so team members need not interact in novel ways to determine how to proceed (Herold, 1978). Teams are thus able to engage primarily in production tasks rather than in planning, deciding, and negotiating. Because they seldom need to interact in novel ways to alter their work approaches, the performance of teams engaged primarily in behavioral tasks is relatively unaffected by social interactions and team processes.

In contrast, production teams with ends and means that are not clearly defined spend a great deal of time on planning and deciding (Goodman, 1986; Herold, 1978). Lack of agreement concerning production means and ends requires the teams to engage in idea generation, decision making, and negotiating (Goodman, 1986). Interaction strongly influences and determines a team's product (Herold, 1978). Intrateam processes are therefore strongly related to performance when teams engage primarily in conceptual tasks. Hence,

> *Hypothesis 1. Relationships between intrateam processes and team performance are moderated by task differences in such a way that linear process-performance relationships are stronger for conceptual tasks than for behavioral tasks.*

Interdependence

Construct definition. Interdependence is defined as the extent to which team members cooperate and work interactively to complete tasks. High interdependence occurs when team members interact cooperatively and depend on each other for information, materials, and reciprocal inputs (Campion et al., 1993; Emery & Trist, 1969).

Research related to interdependence has developed from two perspectives. In one perspective, flowing from organizational theory (e.g., Thompson, 1967; Van de Ven & Ferry, 1980), interdependence is conceived of as a product of technological requirements rather than as a structural feature that can be manipulated. The other perspective, which has been labeled "cooperation requirements," comes from social psychology (e.g., Shaw, 1973). In this perspective, group-level goals and feedback—areas not dependent on technology—are assumed to affect interdependence (Saavedra et al., 1993). Because several studies (Campion et al., 1996; Shea & Guzzo, 1987; Wageman, 1995) have shown that teams with similar technologies vary widely in their amount of interdependence, we adopted the social psychology conceptualization of interdependence as a feature of teams that can be controlled.

Hypothesized relationships. Gladstein (1984) examined, but found no effect for, interdependence as a moderator of the process-performance relationship. Rather than a moderator effect, the model shown in Figure 1 hypothesizes an interdependence-performance relationship that is mediated by process and moderated by task type. This conceptualization is consistent with studies showing a curvilinear relationship between interdependence and performance. For instance, Wageman (1995) found that work groups operating either primarily as individuals or cooperatively with substantial interdependence had higher performance than groups with moderate interdependence. Saavedra and colleagues (1993) also found that moderately interdependent teams received the lowest ratings for both quality and quantity of outputs. We predicted a similar U-shaped relationship between interdependence and team performance. However, in order to test the model presented in Figure 1, we developed hypotheses related both to mediation by process variables and to moderation by task differences.

The relationship between interdependence and process we predict is similar to the interdependence-performance relationship; interdependence is predicted to relate curvilinearly with such aspects of process as communication, conflict, shirking, and flexibility. When interdependence is very low, team members operate as individuals, and their work can be structured around the individual-level work design principles outlined by Hackman and Oldham (1980). Little interaction is required, and team members pursue their personal interests with little need for communication and low potential for conflict (Neck, Stewart, & Manz, 1996). This situation facilitates member flexibility because learning a distinct set of tasks for an individual position is much easier than developing the extensive social relationships that are necessary to coordinate interdependent roles (Manz & Newstrom, 1990). Individual contributions are also highly salient and easily identifiable, reducing the likelihood of team member shirking (Hardy & Latane, 1986; Kidwell & Bennett, 1993).

Intrateam processes are similarly expected to be synergistic for teams at the high end of the interdependence continuum. However, in this case the relationship is facilitated by group rather than individual principles of work structure. The intense interaction created by high interdependence results in a crystallization of group norms, meaning that team members develop a high level of agreement concerning desirable and undesirable behavior (Hackman, 1992). Teams with crystallized norms tend to experience little conflict because team member behavior is guided by shared expectations rather than by individual desires (Jackson, 1975). The interactive nature of the work process itself also encourages an open flow of communication (Thompson, 1967). Team member flexibility is enhanced because boundaries between individual job assignments are de-emphasized and members learn new skills from observing and interacting closely with their coworkers (Trist, 1981). Moreover, interaction develops a cohesive team identity that creates esprit de corps and motivates team members by encouraging them to subjugate personal interests for the interests of the team as a whole (Mudrack, 1989; Murnighan & Conlon, 1991).

In contrast to teams with high and low interdependence, teams with moderate interdependence are predicted to experience process difficulties. Moderately interdependent teams have a need for intermittent dialogue between team members, but team member interactions are not consistent and intense enough to develop open communication channels. An increased dependence on others requires the sacrifice of individual autonomy and interest, which can result in conflict when interdependence is not high enough to assure the crystallization of group norms (Jackson, 1975). Flexibility is expected to decrease because it becomes critical for workers to develop the extensive social relationships that are necessary for learning how to coordinate their work with the tasks performed by their teammates (Manz & Newstrom, 1990); yet interaction is not extensive enough for members to actually develop strong ties and thereby learn informally from one another. Moderate interdependence also diffuses responsibility but fails to develop cohesion and team identity, factors that in combination suggest an increased likelihood that team members will shirk (Mudrack, 1989).

Moderate interdependence thus fails to optimize work structure from either an individual or a group perspective, suggesting that interdependence will exhibit a U-shaped relationship with team process. As shown in Figure 1, the curvilinear interdependence-process relationship will combine with the moderated process-performance relationship to explain the interdependence-performance relationship. Thus,

Hypothesis 2. Interdependence within work teams is curvilinearly associated with intrateam processes in such a way that low and high, but not moderate, levels of interdependence correspond with synergistic processes.

Hypothesis 3. Interdependence within work teams is curvilinearly associated with performance for teams engaged primarily in conceptual tasks in such a way that low and high levels of interdependence correspond with high team performance and moderate levels of interdependence correspond with low team performance.

Hypothesis 4. The U-shaped relationship between interdependence and performance is significantly weaker for teams engaged primarily in behavioral rather than conceptual tasks.

Hypothesis 5. Intrateam processes mediate the relationship between interdependence and team performance.

Team Self-Leadership

Construct definition. Building on previous work (e.g., Hackman, 1986; Manz, 1992; Walton & Hackman, 1986), we define team self-leadership as the extent to which teams have the freedom and authority to lead themselves independent of external supervision. Teams with high self-leadership decide how tasks should be carried out, as well as what should be done and why. They are given responsibility and authority for their behavior, and team members rather than supervisors make decisions and organize work processes.

Team self-leadership does not, however, imply the absence of a leader. A self-leading team can have a leader who encourages the team to lead itself (Manz & Sims, 1987). Team self-leadership is not compromised by the leader unless he or she seeks to impose hierarchical control rather than facilitate the team's self-managing capacity (Stewart & Manz, 1995).

Hypothesized relationships. Although there has been some empirical work on interdependence, very little empirical research has examined the relationship between team self-leadership and performance. However, as shown in Figure 1, team self-leadership is expected to influence team processes. Higher levels of team self-leadership diminish the prominence of a central leader, which encourages the development of a decentralized communication network (Shaw, 1964). Although decentralized networks can sometimes result in a dysfunctional focus on information that is already shared among team members (Larson, Christensen, Abbott, & Franz, 1996), most extant evidence supports the idea that decentralization encourages open communication within groups (Glanzer & Glaser, 1961; McGrath, 1984). Team self-leadership can also help teams effectively manage conflict, as the presence of an external leader can sometimes inhibit trust between team members (Eisenstat, 1990) and discourage the development of long-term mechanisms for resolving member conflict (Manz & Sims, 1987).

Greater team self-leadership is also expected to correspond with decreased shirking because employees have greater commitment and feelings of personal ownership (Pearce & Ravlin, 1987). Shirking decreases as team members engage in mutual monitoring to collectively control actions (Barker, 1993). Moreover, higher levels of team self-leadership should result in increased member flexibility, as variation in behavior within and among teams is expected to increase when control is decentralized (Manz & Stewart, 1997). Thus, team autonomy increases member flexibility by allowing workers to learn from one another and adjust their efforts to obtain the inputs most needed at any particular time (Trist, 1981).

Team self-leadership should thus correspond linearly with synergistic team processes. As shown in Figure 1, the linear team self-leadership relationship will combine with the moderated process-performance relationship to explain the relationship between team self-leadership and performance. Hence,

Hypothesis 6. Higher levels of team self-leadership exhibit a positive, linear relationship with synergistic intrateam processes.

Hypothesis 7. Higher levels of team self-leadership exhibit a positive, linear relationship with higher levels of team performance for teams engaged primarily in conceptual tasks.

Hypothesis 8. The positive, linear relationship between team self-leadership and team performance is significantly weaker for teams engaged primarily in behavioral rather than conceptual tasks.

Hypothesis 9. Intrateam processes mediate the relationship between team self-leadership and team performance.

METHODS

Research Sample

Our research sample consisted of employees working in teams at three different manufacturing plants. We collected data from 636 participants working in 47 teams. However, outlier analyses suggested that measures for two of the teams consistently exerted an undue amount of influence on statistical tests.[1] We thus eliminated data from these two teams, leaving a sample of 626 individuals in 45 teams. Age, gender, and tenure within firms and teams were fairly consistent. The average age of team members was 42 years; 56 percent were women, 98 percent were Caucasian, and the median level of education was high school completion (the range was from ninth grade to completion of graduate school). Average tenure within the studied organizations was almost 15 years, but teams were a relatively new innovation in these plants, and tenure within the teams averaged only 3.47 years (s.d. = 1.32, range = 1.5–5.5 years). Average team size was 14 members (s.d. = 7.65; range = 3–34).

Measures

Team performance. We assessed team performance via supervisor ratings. We adopted a common instrument measuring eight dimensions of performance, and supervisors rated each team as a unit. Consistent with appraisal research, assessments of both team outcomes and team behaviors were included (Cardy & Dobbins, 1994). The dimensions were knowledge of tasks, quality of work, quantity of work, initiative, interpersonal skills, planning and allocation, commitment to the team, and overall performance. We measured each dimension with a single item using a five-point behavior-anchored scale (1 = somewhat below requirements, 5 = consistently exceeds requirements). Because factor analysis revealed a single factor underlying both the behavioral and the outcome performance measures, we combined responses to the eight items into a single score representing overall team performance. The coefficient alpha for the eight-item scale was .83.

Interdependence. We measured interdependence with a seven-item scale adapted from Kiggundu's (1983) interdependence scale. Items applicable to teams were adopted, and the scale focuses on the extent to which tasks performed by members are interrelated within a team. Items include (1) "Other members of my team depend on my performance to do their work" and (2) "How other team members do their work has an impact on my performance." The coefficient alpha of the scale was .74. However, we needed to obtain agreement among raters to aggregate the individual responses into a team-level construct.

James (1982) recommended two intraclass correlations (ICCs) for assessing agreement of team members. ICC(1) indicates the extent of agreement among ratings from members of the same team. James (1982) conducted a survey of published articles and reported a range of .00 to .50 with a median of .12 for ICC(1). ICC(2) indicates whether teams can be differentiated on the variables of interest. ICC(2) is expected to exceed the .70 reliability convention (James, 1982). For our interdependence measure, the value of ICC(1) was .21, and the value of ICC(2) was .73. These values suggest acceptable agreement and support aggregation. In order to properly test for curvilinear relationships, we also performed *Z*-score transformations on the interdependence scores (Aiken & West, 1991).

Team self-leadership. We assessed team self-leadership by asking team members to report whether an external supervisor or the team itself performed activities representing leadership. We reviewed lists of tasks that self-leading teams assume from traditional supervisors (i.e., Manz, 1992; Manz & Sims, 1993) and created a catalog of 20 items. Each item identified a task (for instance, conducting meetings, changing the work process, determining overall business strategy) and asked team members to respond to a forced-choice scale that indicated who was responsible for completing that task. Responses depicting sole managerial responsibility received a value of 1, responses indicating responsibility shared between a supervisor and a team, a 3, and responses suggesting total team responsibility, a 5. The mean score for the 20 items

[1] Because we were concerned that the outliers might have an inordinate effect on the regression results, we assessed their influence using both the DFFITS measure and Cook's distance measure (Neter, Wasserman, & Kutner, 1989). Evaluation of these measures revealed two cases that had larger than acceptable effects on the regression equations. One team reported that they did not engage in any behavioral tasks. The other team reported a very low level of interdependence and a relatively high level of behavioral tasks. Elimination of both cases actually reduced the magnitude of the moderation effect for task type. In order to provide conservative tests, we thus eliminated data related to both teams from all analyses.

was our measurement, with higher scores representing greater team self-leadership. The ICC(1) for self-leadership was .28, and the ICC(2) was .80, indicating acceptable agreement.

Task type. We asked team members to indicate the percentage of time their teams spent working on each of the following task types taken from McGrath (1984): generating ideas and plans, choosing between alternatives, negotiating conflicts, and executing work. We used the percentage allocated to the executing work category as an indicator of task type. Higher values represent an increased amount of time for behavioral tasks. Analyses justified aggregation for task type, as the ICC(1) was .20 and the ICC(2) was .72.

Intrateam process. Following the definitions provided by Hackman (1987), we chose communication and conflict as indicators of social process, and shirking and flexibility as indicators of task-related process. We measured communication with a ten-item openness-to-communication scale originally developed by O'Reilly and Roberts (1976). The scale includes items like "It is easy to talk openly to all members of this group." Higher scores represented more open communication. The coefficient alpha for this scale was .87, the ICC(1) was .24, and the ICC(2) was .75.

We measured conflict with Rahim's (1983) eight-item measure of intragroup conflict. Example items are (1) "There is (not) harmony within my group" and (2) "There are clashes between subgroups within my group." Higher values represent greater conflict. The coefficient alpha was .83, the ICC(1) was .21, and the ICC(2) was .71.

We assessed shirking with three workload-sharing items from Campion and colleagues (1993). Examples of reverse-coded items are (1) "Everyone on my team does their fair share of the work" and (2) "No one in my team depends on other team members to do the work for them." Higher values represent greater individual shirking within a team. The coefficient alpha was .82, the ICC(1) was .23, and the ICC(2) was .74.

We assessed the flexibility of team member inputs with the three-item member flexibility scale developed by Campion and colleagues (1993). Examples of items are (1) "Most members of my team know each other's jobs" and (2) "It is easy for the members of my team to fill in for one another." Higher scores represent greater team member flexibility of inputs. The coefficient alpha was .69, the ICC(1) was .27, and the ICC(2) was .79.

RESULTS

Correlation and Moderation Analyses

Table 1 provides descriptive statistics and zero-order correlation coefficients for all variables. The extent to which teams engaged in behavioral tasks correlated positively with interdependence (r = .53, $p < .01$) and negatively with team self-leadership ($r = -.34$, $p < .05$). Teams with longer tenure reported less self-leadership ($r = -.30$, $p < .05$). As expected, synergistic intrateam process variables were positively correlated with performance (r = .36, $p < .05$, for communication; $r = .34$, $p < .05$, for member flexibility), and the relationships between harmful processes and performance were negative ($r = -.48$, $p < .01$, for conflict; $r = -.44$, $p < .05$, for shirking). The process measures were all significantly interrelated (absolute r = .30–.85, $p < .05$). Team size, tenure, and a dummy variable representing the firms were also explored as control variables. However, the inclusion of these controls did not alter the results of any statistical tests,

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

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9
1. Task interdependence	3.56	0.41									
2. Team self-leadership	3.43	0.33	−.27								
3. Task type	0.50	0.17	.53**	−.34*							
4. Communication	3.39	0.29	−.12	−.17	.18						
5. Conflict	2.84	0.46	.05	.02	−.10	−.85**					
6. Shirking	3.00	0.49	.04	−.02	−.04	−.58**	.74**				
7. Flexibility	3.68	0.48	.55**	−.06	.54**	.30*	−.37*	−.34*			
8. Team size	13.91	7.65	.29	−.12	.36*	−.10	.14	.22	.09		
9. Team tenure	3.47	1.33	−.07	−.30*	.24	.11	−.01	.13	.10	.16	
10. Supervisor ratings	3.50	0.42	.01	−.12	.09	.36*	−.48**	−.44*	.34*	−.10	.20

[a] N = 45 (teams).
* $p < .05$
** $p < .01$

and because our sample was relatively small, the following tables report statistical tests that do not include team size, team tenure, and organization source as control variables.

Hypothesis 1 predicts a moderating effect for task type. We tested Hypothesis 1 separately for each of the four process variables using hierarchical regression analysis. Moderation would be supported by a significant change in the multiple squared correlation coefficient (R^2) when an interaction between a process variable and a task type is included. As shown in Table 2, moderation was not supported for communication ($\Delta R^2 = .07$, n.s.) or flexibility ($\Delta R^2 = .02$, n.s.); moderation was supported for conflict ($\Delta R^2 = .11$, $p < .05$) and shirking ($\Delta R^2 = .28$, $p < .05$). The negative relationship with performance for both conflict and shirking was stronger for conceptual tasks than for behavioral tasks, as predicted.

Relationships with Interdependence

Table 3 reports a series of hierarchical models used to test Hypotheses 2 through 5. In each regression, interdependence was entered in step 1, and interdependence squared was entered in step 2. A significant change in R^2 in step 2 indicates a curvilinear relationship. Hypothesis 2 predicts a U-shaped relationship between interdependence and intrateam process. This prediction is supported for communication ($\Delta R^2 = .35$, $p < .01$) and conflict ($\Delta R^2 = .24$, $p < .01$), but not for shirking ($\Delta R^2 = .05$, n.s.) or flexibility ($\Delta R^2 = .05$, n.s.). Consistent with expectations, high and low levels of interdependence are associated with perceptions of more open communication and decreased conflict.

TABLE 2
Results of Hierarchical Regression Analyses Testing for Interactions Affecting Performance[a]

Step	Independent Variable	Total R^2	ΔR^2
1	Team communication	.13*	.13*
2	Task type	.13	.00
3	Team communication × task type	.20*	.07
1	Team conflict	.23**	.23**
2	Task type	.23**	.00
3	Team conflict × task type	.34**	.11*
1	Team member shirking	.19**	.19**
2	Task type	.19*	.00
3	Team member shirking × task type	.47**	.28**
1	Team member flexibility of inputs	.12*	.12*
2	Task type	.13	.01
3	Team member flexibility of inputs × task type	.15	.02

[a] $N = 45$ (teams).
* $p < .05$
** $p < .01$

Hypothesis 3 predicts a U-shaped relationship between interdependence and performance for teams primarily engaged in conceptual tasks. Hypothesis 4 predicts that this relationship will be significantly weaker for teams primarily engaged in behavioral tasks. The results in Table 3 for step 5 reveal that task type significantly moderates the relationship between interdependence and performance ($\Delta R^2 = .15$, $p < .01$). As shown in Figure 2, Hypothesis 3 is supported, as teams primarily engaged in conceptual tasks had their highest performance with either low or high levels of interdependence. Counter to Hypothesis 4, the regression plot (Figure 2) also shows that for teams engaged primarily in behavioral tasks, interdependence and performance actually exhibit an inverse curvilinear (∩-shaped) relationship, with the highest level of performance being associated with moderate interdependence.

Hypothesis 5 predicts that intrateam processes will mediate the relationship between interdependence and team performance. Because the potential mediator effect might combine with a moderator effect, an appropriate method of testing for mediation was to create a median split on the moderator variable and to then independently assess mediation in two subsamples, one subsample reporting relatively more conceptual tasks, and the other reporting more behavioral tasks.

The median value for task type, .45, served as the splitting point for the two categories. One category of teams—labeled conceptual—consisted of all teams reporting that they spent less than 44 percent of their time on behavioral tasks ($\bar{x} = 36\%$). The other category of teams—labeled behavioral—consisted of teams each reporting spending more than 48 percent of their time on behavioral tasks ($\bar{x} = 63\%$). We conducted separate regression analyses to further assess mediation in each task type.

We compared a model regressing performance on interdependence and interdependence squared with a similar model in which we first controlled for the effects of intrateam processes (Hollenbeck, Ilgen, LePine, Colquitt, & Hedlund, 1998). In the conceptual task subsample, the increase in R^2 of .21 ($p < .05$) for a curvilinear effect attenuated to an increase in R^2 of .03 (n.s.) when the effect of process was controlled. In the behavioral task subsample, the increase in R^2 of .22 ($p < .05$) attenuates to an increase in R^2 of .10 (n.s.) in the controlled model. Process thus mediates 86 percent of the effect of interdependence on performance for teams en-

TABLE 3
Results of Hierarchical Regression Analyses Testing Hypotheses 2–5[a]

		Communication		Conflict		Shirking		Flexibility		Performance	
Step	Independent Variable	Total R^2	ΔR^2	Total R^2	ΔR^2	Total R^2	ΔR^2	Total R^2	ΔR^2	Total R^2	ΔR^2
1	Interdependence	.01	.01	.00	.00	.00	.00	.30**	.30**	.00	.00
2	Interdependence squared	.36**	.35**	.24**	.24**	.05	.05	.35**	.05	.07	.07
3	Task type	.40**	.04	.25**	.01	.05	.00	.42**	.07*	.07	.00
4	Interdependence by task type	.42**	.02	.30**	.05	.13	.08	.43**	.01	.07	.00
5	Interdependence squared × task type	.42**	.00	.30*	.00	.14	.01	.43**	.00	.22	.15**

[a] $N = 45$ (teams).
* $p < .05$
** $p < .01$

gaged in conceptual tasks and 55 percent of the effect for teams engaged in behavioral tasks. Hypothesis 5, predicting process mediation of the interdependence-performance relationship, is thus supported strongly for teams engaged in conceptual tasks and moderately for teams engaged in behavioral tasks.

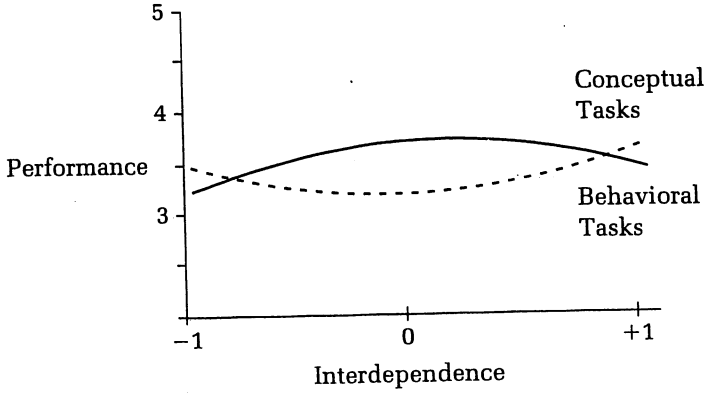
Relationships with Team Self-Leadership

Table 4 reports a series of hierarchical regression models used to test Hypotheses 6 through 9. In each model, step 1 regresses the dependent variables on team self-leadership. Step 2 includes task type as an additional independent variable and provides a comparison model for hierarchically assessing a moderator effect. Step 3 includes the cross-product term as a test for moderation. Hypothesis 6, predicting linear relationships between team self-leadership and processes, was not supported, as a step 1 relationship was not detected between team self-leadership and any of the process measures.

As shown in Table 4, the relationship between team self-leadership and performance is moderated by task type ($\Delta R^2 = .19$, $p < .01$). Hypothesis 7 is supported, as increased team self-leadership is associated with higher performance for teams engaged primarily in conceptual tasks. However, counter to Hypothesis 8, the relationship between team self-leadership and performance goes beyond mere attenuation and actually becomes negative for teams engaged primarily in behavioral tasks.

Hypothesis 9, predicting that intrateam processes would mediate the relationship between team self-leadership and team performance, was not supported, as the tests of Hypothesis 6 failed to link team self-leadership and intrateam processes. Further tests related to mediation for team self-leader-

FIGURE 2
Regression Plot for Relationships between Interdependence and Performance[a]



[a] As an aid to interpretation of the interaction effect, the continuous task-type variable is bifurcated at the median, and the continuous interdependence variable is plotted at −1, 0, and +1 standard deviations from the mean (Cohen & Cohen, 1983).

TABLE 4
Results of Hierarchical Regression Analyses Testing Hypotheses 6–9

Independent Variable	Communication		Conflict		Shirking		Flexibility		Performance	
	Total R^2	ΔR^2	Total R^2	ΔR^2	Total R^2	ΔR^2	Total R^2	ΔR^2	Total R^2	ΔR^2
Team self-leadership	.03	.03	.00	.00	.00	.00	.00	.00	.01	.01
Task type	.05	.02	.01	.01	.00	.00	.31	.31**	.01	.00
Team self-leadership × task type	.05	.00	.01	.00	.05	.05	.32	.01	.20*	.19**

[a] $N = 45$ (teams).
* $p < .05$
** $p < .01$

ship were therefore not justified (Baron & Kenny, 1986).

DISCUSSION

Relatively little is known about whether there is an optimal structure for work teams. We hypothesized that two structural characteristics, interdependence and team self-leadership, would relate to team performance. We expected the influence of these two elements of a team's social system to be contingent on its technical system, specifically, the type of tasks that it performs. Our results illustrate that structural characteristics related to the allocation of tasks, responsibilities, and authority do indeed influence team performance. Many of our hypotheses were supported, illustrating that the optimal amount of interdependence and team self-leadership varies with the amount of time a team spends performing behavioral production tasks or conceptual tasks like planning, deciding, and negotiating.

For teams engaged primarily in conceptual tasks, our expectation of a U-shaped interdependence-performance relationship was confirmed. This result replicates the findings reported by Wageman (1995) and Saavedra and his coauthors (1993). However, our findings extend previous work by suggesting that this relationship may only exist for teams primarily engaged in conceptual tasks. Furthermore, the mediation focus of our study allows substantial insight into how interdependence is related to team performance when teams engage in conceptual tasks. In particular, we found that intrateam processes mediated the relationship between interdependence and performance in these teams. Very high or low levels of interdependence were related to both open communication and less conflict among team members. These socioemotional processes were in turn associated with higher team performance. The extremes of interdependence thus seem to be alternative paths to a desirable end when teams perform work that has a conceptual focus.

Consistent with much of the literature related to team autonomy, greater team self-leadership was also found to correspond with higher performance for teams primarily engaged in conceptual tasks. However, our results did not provide support for process variables as mediators of the relationship between team self-leadership and performance. This finding suggests that the input-process-output model may be in need of revision. Of particular note are the revisions suggested by Ancona and colleagues (Ancona, 1990; Ancona & Caldwell, 1992), who argued for the inclusion of factors related to external team relationships. Building on this work, in future studies researchers should examine whether structural factors like team self-leadership affect performance on some tasks through relationships with other teams and organizations rather than through intrateam relationships.

We predicted that relationships between team structures and performance would attenuate for teams primarily engaged in behavioral tasks rather than conceptual tasks, but our results suggest more than mere attenuation. Team designs that incorporated moderate levels of interdependence and greater external leadership were actually found to be more effective when teams were engaged in behavioral tasks, suggesting that relationships between structure and performance are the inverse of those for teams primarily engaged in conceptual tasks. Unfortunately, the intrateam process measures included in this study were generally unrelated to performance for teams performing these tasks, thereby providing little insight into the mechanisms that might explain why the direction of the relationships reversed. In future studies, other variables, such as external relationships and individual contributions, should be examined as potential mediators.

Finally, although the results demonstrate that type of task is an important moderator, it is instructive to look at the zero-order correlations between the two team structure characteristics and the measures of task type. These correlations suggest that teams with behavioral tasks tend to have greater interdependence. Perhaps this is because interdependence is easier to create when a task is routine and behavioral. However, our analyses suggest that teams primarily performing conceptual tasks are the very ones that can benefit most from relatively high levels of interdependence. The zero-order correlations also suggest that teams performing more conceptual tasks have more self-leadership, and our analyses suggest this greater self-leadership is functional.

A few limitations of this study should be noted. First, the data are correlational in nature. Future studies that directly manipulate interdependence and self-leadership are needed to clearly provide evidence of causal relationships. The intrateam process variables were also collected from team members rather than supervisors, meaning that a common response bias may explain their relationships with the team structure characteristics. However, because many of these relationships were curvilinear and moderated by task type, as hypothesized, it is difficult to simply explain them as due to a common data source.

Another limitation is that the data are cross-sectional rather than longitudinal. Teams with high and low self-leadership may experience different development processes. Wellins, Byham, and Wilson (1991) argued that self-leading teams take substantial time to develop and mature. The magnitude and direction of the zero-order correlation between team tenure and team self-leadership suggests the possibility that some teams high on self-leadership did not have the opportunity to fully develop processes and thereby maximize performance. Nevertheless, average tenure on the teams was nearly three and a half years, decreasing the likelihood that short tenure explains our negative finding, but at the same time making it unclear whether our findings generalize to newly formed work teams.

An additional limitation is the relatively small sample. Even though our findings are based on data provided by 626 individuals, the team level of analysis required comparisons based on the sample of 45 teams. Although this sample size is similar to those in many other team-level studies, statistical power is limited. Yet, the relatively strong effects, particularly the interactive effects, that we observed across dependent variables seem to provide evidence for robust relationships between team structure, team processes, type of task, and team performance. The absolute size of the effects also suggests that gaining insight into team structure is critical for understanding work teams.

With these limitations taken into account, the data do have important implications for practice, theory, and research. Practically, the results have important implications for determining optimal methods of work team design. Organizations using teams to complete conceptual tasks can benefit from either very high or very low levels of interdependence, as well as greater self-leadership. In contrast, when work tasks are primarily behavioral in nature, moderate amounts of interdependence and greater external leadership seem best.

From a theoretical perspective, we built on organization-level findings and showed that differences in how responsibilities are apportioned and coordinated correspond to variance in performance at the team level. Consistent with sociotechnical systems theory, the effect of these social elements is moderated by technical demands (tasks). Our results also support the efficacy of the input-process-output model for explaining some aspects of teams. In particular, the model effectively explains relationships between interdependence and performance for teams primarily engaged in conceptual tasks. However, the input-process-output model was less effective for explaining performance differences on behavioral tasks and relationships with team self-leadership. This finding adds to previous acknowledgments that the input-process-output model may be incomplete (Ancona, 1990; Cohen & Bailey, 1997; Hackman, 1987) and suggests that alternative models need to be developed and empirically tested.

In view of our findings, researchers should acknowledge that a single optimal structure for work teams does not exist. It is important for researchers to explore the boundary conditions of their models, particularly in relation to task differences. As organizations continue to design work around teams, future studies that account for task differences and systematically examine the mechanisms through which structural characteristics affect teams will become increasingly beneficial. The pursuit and application of such research will help organizations realize the full potential of using teams to accomplish work.

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