Determinants of Innovative Behavior: A Path Model of Individual Innovation in the Workplace
Author(s): Susanne G. Scott and Reginald A. Bruce
Source: *The Academy of Management Journal*, Vol. 37, No. 3 (Jun., 1994), pp. 580-607
Published by: Academy of Management
Stable URL: http://www.jstor.org/stable/256701
Accessed: 06/03/2011 15:18

© Academy of Management Journal
1994, Vol. 37, No. 3, 580–607.

DETERMINANTS OF INNOVATIVE BEHAVIOR: A PATH MODEL OF INDIVIDUAL INNOVATION IN THE WORKPLACE

SUSANNE G. SCOTT
University of Colorado at Colorado Springs
REGINALD A. BRUCE
University of Louisville

The present study integrated a number of streams of research on the antecedents of innovation to develop and test a model of individual innovative behavior. Hypothesizing that leadership, individual problem-solving style, and work group relations affect innovative behavior directly and indirectly through their influence on perceptions of the climate for innovation, we used structural equation analysis to test the parameters of the proposed model simultaneously and also explored the moderating effect of task characteristics. The model explained approximately 37 percent of the variance in innovative behavior. Task type moderated the relationship between leader role expectations and innovative behavior.

The central role of innovation in the long-term survival of organizations (Ancona & Caldwell, 1987) provokes continuing interest among social scientists and practitioners alike. Since the foundation of innovation is ideas, and it is people who "develop, carry, react to, and modify ideas" (Van de Ven, 1986: 592), the study of what motivates or enables individual innovative behavior is critical. However, West and Farr noted that "there has been scant attention paid to innovation at the individual and group levels" (1989: 17). The present study integrated a number of independent streams of research on the antecedents of creativity, innovation, and organizational climate to develop and test a theoretical model of individual innovative behavior.

Van de Ven (1986) noted that one of the central problems in the management of innovation is the management of attention. Managing attention is difficult because individuals gradually adapt to their environments in such a way that their awareness of need deteriorates and their action thresholds reach a level at which only crisis can stimulate action. A number of theorists

M. Ann Welsh and Harold Angle provided thoughtful and insightful comments during both the conceptual and data analysis stages of the study. Deborah Bruce was extremely helpful in the crafting of the multiple drafts of this article. We would like to enthusiastically thank each of them as well as this journal's reviewers for their constructive assistance. This research was funded in part by grants from the University of Cincinnati Research Council.

have suggested that climate may channel and direct both attention and activities toward innovation (e.g., Amabile, 1988; Isaksen, 1987; Kanter, 1988). Following James, Hater, Gent, and Bruni, we defined climate as individual cognitive representations of the organizational setting "expressed in terms that reflect psychologically meaningful interpretations of the situation" (1978: 786). The model guiding this study draws on the social interactionist approach and posits that leadership, work group relations and problem-solving style affect individual innovative behavior directly and indirectly through perceptions of a "climate for innovation."

The study setting was a research and development subunit. The organizational literature has tended to treat R&D as a special case with little relevance to other types of functional areas within organizations. Because the central tasks of R&D traditionally have involved unstructured problem solving, and unstructured problem solving is becoming increasingly common throughout organizations (Walton, 1985), the study of R&D professionals may have substantial relevance for promoting innovation among all organizational participants.

The present study also investigated whether the type of job or task an individual is engaged in influences the posited relationships. Task routineness and the amount of discretion granted individuals in task performance have previously been reported to moderate the relationship between climate and performance (Middlemist & Hitt, 1981). These same variables have also been implicated as important boundary conditions in models of creativity (e.g., Amabile, 1988). Therefore, we tested whether type of job assignment moderated the relationship between innovative behavior and each of the predictors in the model.

THEORETICAL BACKGROUND AND MODEL

Definition of Innovative Behavior

The terms creativity and innovation are often used interchangeably in research studies, and the distinction between the two concepts may be more one of emphasis than of substance (West & Farr, 1990). Nonetheless, some agreement about the terms' definitions has emerged recently; creativity has to do with the production of novel and useful ideas (Mumford & Gustafson, 1988), and innovation has to do with the production or adoption of useful ideas and idea implementation (Kanter, 1988; Van de Ven, 1986). Although creativity is often framed as "doing something for the first time anywhere or creating new knowledge" (Woodman, Sawyer, & Griffin, 1993: 293), innovation also encompasses the adaptation of products or processes from outside an organization. Finally, researchers exploring innovation have explicitly recognized that idea generation is only one stage of a multistage process on which many social factors impinge (Kanter, 1988).

From this perspective, individual innovation begins with problem recognition and the generation of ideas or solutions, either novel or adopted.

During the next stage of the process, an innovative individual seeks sponsorship for an idea and attempts to build a coalition of supporters for it. Finally, during the third stage of the innovation process, the innovative individual completes the idea by producing "a prototype or model of the innovation . . . that can be touched or experienced, that can now be diffused, mass-produced, turned to productive use, or institutionalized" (Kanter, 1988: 191).

Thus, innovation is viewed here as a multistage process, with different activities and different individual behaviors necessary at each stage. Since innovation is actually characterized by discontinuous activities rather than discrete, sequential stages (Schroeder, Van de Ven, Scudder, & Polley, 1989), individuals can be expected to be involved in any combination of these behaviors at any one time.

A Model of Individual Innovative Behavior

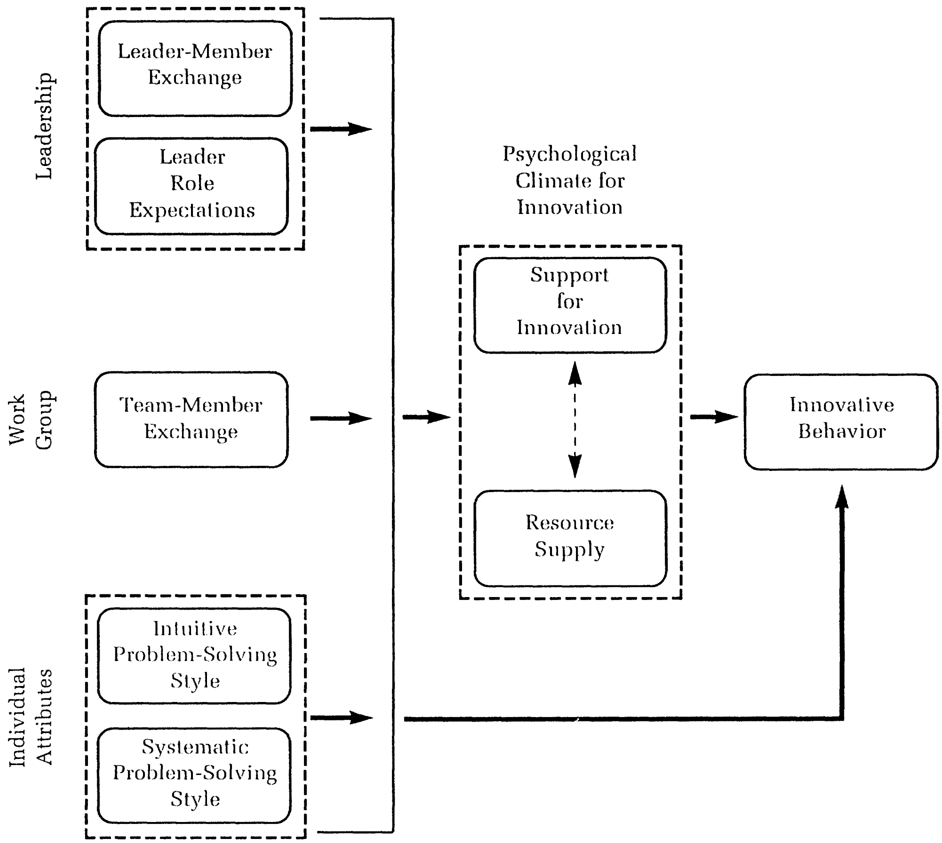
In the model tested here (Figure 1), we viewed individual innovative behavior as the outcome of four interacting systems—individual, leader, work group, and climate for innovation.

Climate and innovative behavior. Studies at both the organizational and subunit level have offered empirical support for climate's effects on innovation (Abbey & Dickson, 1983; Paolillo & Brown, 1978; Siegel & Kaemmerer, 1978). However, empirical study of climate's effects on individual innovative behavior has been limited (Amabile and Gryskiewicz [1989] is an exception).

At the individual level, climate is a cognitive interpretation of an organizational situation that has been labeled "psychological climate" (James, James, & Ashe, 1990). Proponents of psychological climate theory posit that individuals respond primarily to cognitive representations of environments "rather than to the environments per se" (James & Sells, 1981). Climate represents signals individuals receive concerning organizational expectations for behavior and potential outcomes of behavior. Individuals use this information to formulate expectancies and instrumentalities (James, Hartman, Stebbins, & Jones, 1977). People also respond to these expectations by regulating their own behavior in order to realize positive self-evaluative consequences, such as self-satisfaction and self-pride (Bandura, 1988).

Schneider (1975) suggested that there are many types of climates, and Schneider and Reichers wrote that "to speak of organizational climate per se, without attaching a referent, is meaningless" (1983: 21). Not all of the dimensions contained within omnibus climate measures (e.g., Jones & James, 1979; Pritchard & Karasick, 1973) are relevant to the criteria of interest in a specific research study. For example, in the often-cited Abbey and Dickson (1983) study of innovative performance among R&D units, only two of the ten generic work-climate dimensions examined, performance-reward dependency and flexibility, were consistently correlated with measures of R&D innovation. Abbey and Dickson concluded that the climate of innovative

FIGURE 1
Determining Innovative Behavior: A Hypothetical Model



R&D units is characterized by rewards given in recognition of excellent performance and by organizational willingness to experiment with innovative ideas.

Others have noted that innovative organizations are characterized by an orientation toward creativity and innovative change, support for their members in functioning independently in the pursuit of new ideas (Kanter, 1983; Siegel & Kaemmerer, 1978), and a tolerance for diversity among their members (Siegel & Kaemmerer, 1978). Finally, adequate supplies of such resources as equipment, facilities, and time are critical to innovation (Amabile, 1988; Angle, 1989; Taylor, 1963), and the supply of such resources is another manifestation of the organizational support for innovation.

Hence, given climate's conceptualization as a determinant of individual behavior and the previous empirical support for climate's effect on organizational and departmental innovation, we predicted that the degree to which organization members perceived an organizational climate as supportive of innovation would affect individual innovative behavior.

Hypothesis 1: The degree to which individuals perceive dimensions of organizational climate as supportive of innovation is positively related to their innovative behavior.

Leadership and innovative behavior. Numerous writers have implicated leadership as critical in the innovation process, but such accounts have largely focused on the need for participative or collaborative leadership styles (Kanter, 1983; Pelz & Andrews, 1966) or have provided lists of specific activities that leaders should engage in to allow creativity to emerge (e.g., Amabile, 1988). Theoretical development in this area has been weak as traditional leadership approaches are more relevant to the explanation and prediction of productivity outcomes than to innovation outcomes (Waldman & Bass, 1991). In this study, we investigated two contemporary leadership approaches. Leader-member exchange (LMX) theory (Dansereau, Graen, & Haga, 1975; Graen & Scandura, 1987) was used as it has been previously tied to innovation. We also investigated the effect of the role expectations of leaders on innovative behavior because the consequences of the "Pygmalion effect" (Livingston, 1969) on innovative behavior has yet to be tested. The Pygmalion effect refers to the modification of a focal individual's behavior based on the expectations for that behavior received from another (Eden, 1984).

LMX theory suggests that the quality of the relationship between a supervisor and a subordinate is related to innovativeness (Graen & Scandura, 1987). In essence, theorists posit that supervisors and subordinates engage in a role development process during which understandings are arrived at regarding the amount of decision latitude, influence, and autonomy the subordinates will be allowed (Graen & Cashman, 1975). Over time, some leader-subordinate relationships develop from interactions that are formal and impersonal (low-quality leader-member exchange) to mature interactions characterized by trust, mutual liking, and respect (high-quality leader-member exchange). In these latter relationships, subordinates are allowed greater autonomy and decision latitude, both of which have been shown to be essential to innovative behavior (Cotgrove & Box, 1970; Pelz & Andrews, 1966). Although research on the relationship between leader-member exchange and innovation is still in the nascent stages, preliminary results (e.g., Basu, 1991) have supported a positive relationship between leader-member exchange and innovative behavior.

Hypothesis 2: The quality of leader-member exchange between an individual and his or her supervisor is positively related to the individual's innovative behavior.

Leader-member exchange was also hypothesized to influence innovative behavior indirectly through its influence on the formation of climate perceptions. Contemporary theorists have focused on cognitive sense-making to describe the formation of psychological climate and give primary emphasis to the social influence processes that affect the sense-making process (Ashforth, 1985; Glick, 1985, 1988; Schneider & Reichers, 1983). Central to this approach is the notion that proximal others—those in close psychological proximity to a focal individual, including his or her co-workers and leader—are likely to have a strong influence on the individual's perceptions of psychological climate (Lewin, 1938).

In a recent integration of LMX theory and the extant research on climate, Kozlowski and Doherty (1989) argued that because supervisors are the most salient representatives of management actions, policies, and procedures, subordinates tend to generalize their perceptions of supervisors to their organization at large. Thus, subordinates successfully negotiating high-quality relationships with their supervisors will perceive their organization as providing greater autonomy, decision-making latitude, and supportiveness overall than will subordinates with low-quality relationships with their supervisors. Several studies have reported empirical support for a positive relationship between LMX quality and climate perceptions (Dunegan, Tierney, & Duchon, 1992; Kozlowski & Doherty, 1989). Thus,

> *Hypothesis 3: The quality of leader-member exchange between an individual and his or her supervisor is positively related to the degree to which the individual perceives dimensions of climate as supportive of innovation.*

Managers may have expectations of subordinates that are not negotiated through the role development process suggested by LMX theory. Subordinate roles may be rigidly prescribed by an organization or by technological constraints; for instance, their tasks may be routine or machine-driven. Further, managers may have inflexible expectations for specific roles within their domains or may lack interest in or enough imagination to negotiate subordinates' roles with them (Graen & Scandura, 1987). The expectations that supervisors have for their subordinates are antecedents of the Pygmalion effect, and they have been suggested to shape the behavior of subordinates (Livingston, 1969) by altering their self-expectancies and subsequent motivations (Eden, 1984). Thus,

> *Hypothesis 4: The degree to which a supervisor expects a subordinate to be innovative is positively related to the subordinate's innovative behavior.*

Eden (1984) theorized that managers' expectations of subordinates' performance are communicated to them through the managers' behaviors. As with leader-member exchange, we expected that subordinates' perceptions of their managers' behaviors would be generalized to their organizations at large. More specifically, when managers expect subordinates to be innovative, the subordinates will perceive the managers as encouraging and facilitating their innovative effort. These behaviors will be seen as representative of their organizations at large, and therefore the organizations will be perceived as supportive of innovation.

Hypothesis 5: The degree to which a supervisor expects a subordinate to be innovative is positively related to the degree to which the subordinate perceives dimensions of climate as supportive of innovation.

Work groups and innovative behavior. Although idea generation and evaluation within an organization may sometimes be a solitary activity, more commonly work group members and peers influence individual innovation. Researchers have typically studied work group effects at the group level of analysis, using group outcomes or group innovation as the dependent variable. The influence of work groups on individual innovative behavior has received minimal attention in the literature to date.

Rogers (1954) suggested that the cohesiveness of a work group determines the degree to which individuals believe that they can introduce ideas without personal censure. Others have suggested that collaborative effort among peers is crucial to idea generation (Amabile & Gryskiewicz, 1987; Sethia, 1991). Here, we tested how the quality of the working relationships between individuals and their work groups affected innovative behavior.

Drawing from LMX theory, Seers (1989) suggested that individuals engage in a role-making process with their work groups. This process may result in high-quality team-member exchange (TMX) characterized by mutual trust and respect and in cooperation and collaboration between a focal individual and the work group. Alternatively, the role-making process may result in low-quality team-member exchange, in which the focal individual is not integrated into the work group and collaboration, trust, and respect are low.

Thus, in conditions of high team-member exchange, individuals have additional resources available to them in the form of idea sharing and feedback. We predicted that this availability would be positively related to innovative behavior.

Hypothesis 6: The quality of team-member exchange between an individual and his or her work group is positively related to the individual's innovative behavior.

We also expected the quality of the relationship with a work group to influence climate perceptions. Climate perceptions "emerge out of the interactions that members of a work group have with each other" (Schneider & Reichers, 1983: 30). Further, since work group members are typically more similar to a focal individual than is the group's leader, social information provided by the work group is likely to have a greater influence on individual meaning analysis (Festinger, 1954).

Thus, we suggest that when a work group supports an individual in ways that allow innovation to emerge, offering, for example, cooperation and collaboration, the individual is more likely to see the organization as a whole as being supportive of innovation.

> *Hypothesis 7: The quality of team-member exchange between an individual and his or her work group is positively related to the degree to which individuals perceive dimensions of climate as supportive of innovation.*

Problem-solving style and innovative behavior. Recently, researchers have given increased attention to specific dimensions of cognitive style as antecedents of innovative behavior (e.g., Barron & Harrington, 1981; Jabri, 1991; Kirton, 1976). Kirton proposed that individuals can be located on a continuum ranging from those who have an ability to do things "better" to those who have an ability to do things "differently" and reflecting the qualitatively different solutions they produce to seemingly similar problems. In contrast, Jabri, drawing on Koestler's (1964) work on creative thinking, conceptualized problem-solving style as composed of two independent modes of thinking: associative and bisociative. Associative thinking is based on habit, or following set routines, adherence to rules and disciplinary boundaries, and use of rationality and logic. It represents the systematic problem-solving style. The systematic problem solver, working within established methods or procedures, is likely to generate conventional solutions to problems. Bisociative thinking, in contrast, is characterized by overlapping separate domains of thought simultaneously, a lack of attention to existing rules and disciplinary boundaries, and an emphasis on imagery and intuition. We call this mode the intuitive problem-solving style. The intuitive problem solver has a propensity to process information from different paradigms simultaneously, and is therefore more likely to generate novel problem solutions (Isaksen, 1987).

Neither style is considered preferable per se; it is the fit between problem-solving style and a task and work environment that determines individual task performance (Payne, Lane, & Jabri, 1990). Since the task environment studied here involved R&D, and preliminary site interviews suggested that the primary mission of the unit was the development of novel problem solutions, we predicted that an intuitive problem-solving style would be positively related to innovative behavior and that a systematic problem-solving style would be negatively related to innovative behavior.

> *Hypothesis 8a: The degree to which an individual's problem-solving style is intuitive is positively related to his or her innovative behavior.*

> *Hypothesis 8b: The degree to which an individual's problem-solving style is systematic is negatively related to his or her innovative behavior.*

We also suggest here that problem-solving style is related indirectly to innovative behavior through its effect on climate perceptions. Although most climate research has treated differences in work group members' climate perceptions as error variance (e.g., James et al., 1978), others have argued that individual personalities, values, and cognitive characteristics are important (e.g., James et al., 1990). This study tested the effect of problem-solving style on perceptions of the climate for innovation.

James and colleagues (1990) noted that individuals interpret environmental phenomena by referencing personal values or internal standards. Internal standards or values are also related to the concept of needs. Needs in part determine the value of environmental phenomena to individuals, and "based upon these values, the areas of climate that are likely to be highlighted in their perceptions" (James et al., 1978: 792). Thus, need states, such as the need to be innovative, are likely to make certain aspects of an environment—such as support for innovation—more salient. However, theorists have given the effect of this increasing salience on individual interpretations of environmental stimuli minimal attention. The results of two recent empirical studies suggest that increasing salience results in higher internal standards against which environmental conditions are judged (Eiter, 1991; Isaksen & Kaufmann, 1990).

Given the lack of theoretical development in this area, we considered the test of the relationship between problem-solving style and the climate for innovation exploratory, and thus framed no specific hypotheses prior to testing the model.

Covariates. We included several control variables that may influence climate perceptions, innovative behavior, or both in testing the hypothesized model. Although not of primary interest in this study, the relationship between these variables and the mediating and dependent variables has been well established. Previous work has shown both climate perceptions and innovative behavior to be significantly related to a number of demographic and position variables (James et al., 1990; Mumford & Gustafson, 1988). In this study, we included individual age, R&D tenure, task type, and education as control variables in the prediction of both climate perceptions and innovative behavior.

The Moderating Effect of Task Type

Despite evidence that task type and core technology moderate the relationship between climate perceptions and subunit effectiveness (e.g., Middlemist & Hitt, 1981), there has been little effort to study the moderating effect of task at the individual level. When a task is routine or when individual discretion is low, the relationship between climate and innovative behavior is likely to be weaker than when the task is nonroutine and high discretion is granted. Therefore, type of task may delineate one of the boundary conditions within which the proposed model of individual innovation applies. To test this possibility, we conducted an exploratory analysis of the moderating effect of task type on the emergence of individual innovative behavior.

METHODS

Respondents and Procedure

The respondents for this study included all engineers, scientists, and technicians employed in a large, centralized R&D facility of a major U.S. industrial corporation. The R&D center was engaged in applied research within a specific technology area, and it was organized in three sections: (1) product technology, (2) process technology, and (3) supporting technologies (i.e., laboratory services such as analytical chemistry). Each area was headed by a director who reported to the vice president of research at the site.

Initially, we conducted a series of interviews with the directors and vice president of the R&D center to develop an understanding of how innovation was viewed in the organization and to determine what specific behaviors were seen as critical to innovation. We then conducted semistructured interviews with a stratified sample ($N = 22$) of the R&D engineers, scientists, and technicians to gain an understanding of how the employees viewed innovation and to determine what organizational factors might play a part in the innovative process. This information was used to offer some assurance that the climate measure being used in the study was relevant in this setting.

Questionnaires were administered via company mail to study respondents who completed them during normal working hours. We omitted the responses of the 22 employees who were interviewed in the first stages of the project from the subsequent analysis of the survey data. Participation was voluntary for all employees, and confidentiality of responses was assured. We received 189 questionnaires, a response rate of 85 percent. Incomplete questionnaires reduced the usable responses to 172, of which 108 were from engineers and scientists and 64 were from technicians. The average age of respondents was 40.2 years and their average tenure in the R&D organization was 14.4 years. Men comprised 91.6 percent of the group; 61.6 percent of the respondents had at least baccalaureate degrees, and 41.6 percent had postgraduate degrees. Tests for nonresponse bias did not indicate any differences between respondents and nonrespondents in terms of R&D tenure, level in the hierarchy, job classification, education, or work group.

A second questionnaire was completed by all 26 managers at the research site. These managers rated each of their subordinates on the criterion variables, and they completed an item that assessed their own expectations regarding the role of each subordinate (see the description of measures below).

Measures

Innovative behavior consisted of six items completed by each of the managers for each of their subordinates; the Appendix gives the scale. We developed this measure specifically for use in this study, drawing on Kanter's (1988) work on the stages of innovation and on our interviews with the focal firm's directors and vice president. Responses were made on a five-point Likert-type scale ranging from "not at all" to "to an exceptional degree." Cronbach's alpha on this scale was .89.

To provide some assurances as to the validity of the innovative behavior scale, we obtained an objective measure of each respondent's innovative history from the organization's archives. This measure consisted of the total number of invention disclosures filed by an individual divided by his or her organizational tenure in years. The correlation between the objective measure and the supervisors' ratings of innovative behavior was .33 ($p < .001$).

Problem-solving style was operationally defined by the two subscales of Jabri's (1991) associative/bisociative index. *Systematic problem-solving style* was measured with the ten-item associative scale, and *intuitive problem-solving style* with the nine-item bisociative scale. The response format was a seven-point Likert scale ranging from "likely to enjoy" to "unlikely to enjoy." All responses were reverse-coded, so a high score on the associative scale indicated a preference for systematic problem solving, and a high score on the bisociative scale indicated a preference for intuitive problem solving. Cronbach's alphas for the associative and bisociative scales were .90 and .91, respectively.

Jabri (1991) reported that qualitative testing conducted during the development of the associative/bisociative index suggested the scales had good content validity. In addition, high correlations between individuals' self-ratings of problem-solving style and the supervisors' ratings of these individuals provided some evidence of concurrent validity (r's = .94, associative, and .69, bisociative). Further, the index is very similar in content to the more widely accepted but less accessible Kirton Adaption-Innovation Measure (KAI; Kirton, 1976). For example, sample items from the associative/bisociative index include "linking ideas which stem from more than one area of investigation" (intuitive) and "being methodical and consistent in the way I tackle problems" (systematic). Sample items from the KAI include "copes with several new ideas and problems at the same time" and "is methodical and systematic." Comparison of the two scales provided further evidence of the content validity of the associative/bisociative index.

Leader-member exchange quality was measured using the 14-item scale developed by Graen, Novak, and Sommerkamp (1982). The measure was administered to all engineers, scientists, and technicians. The response format was standardized using a five-point Likert scale ranging from "strongly disagree" to "strongly agree." The scale measures the quality of the relationship between manager and subordinate. Cronbach's alpha for this sample was .90.

The *role expectations* of the leaders were measured by the following single item: "Not all work roles require individuals to be innovative. In fact, it could be argued that effective work groups have a blend of innovative individuals and individuals whose <u>role</u> it is to support the innovation of others. In this context, the role is a set of expectations of the position independent of the person holding the position. Indicate the degree to which you would describe the role for each of your subordinates as being either an innovator or being a supporter of innovation." The supervisors rated each subordinate using a five-point Likert scale ranging from "role requires an innovator" to "role requires a supporter." The item was reverse-coded so that a high value indicated an innovative role and a low one, a supportive role. A second administration of this measure was conducted 14 months after the first ($N = 142$), and test-retest reliability was .87.

Team-member exchange quality was measured using the 12-item scale developed by Seers (1989). The scale was administered to all engineers, technicians, and scientists in the study. The response format was a five-point Likert-type scale ranging from "strongly disagree" to "strongly agree." The scale measures the quality of the working relationship developed between a focal individual and a work group. Cronbach's alpha in this study was .84.

The *climate for innovation* measure was completed by all study participants and contained 26 items. The measure was a modification and extension of the innovative climate measure developed by Siegel and Kaemmerer (1978). The original measure contained three subscales: (1) support for creativity, (2) tolerance of differences, and (3) personal commitment. We did not use the personal commitment subscale in this study because the construct failed to distinguish between innovative and noninnovative organizations in the original Siegel and Kaemmerer (1978) study. Further, it seems likely that commitment is an outcome rather than a dimension of climate.

We examined the published factor structure of the subscales measuring support for creativity and tolerance for differences. Items relating specifically to supervisors were not used in order to minimize conceptual overlap with the LMX measure, thus reducing method variance resulting from common source. We examined the content of the remaining items to assess how well they represented dimensions suggested to be important to innovative performance during the interviews at the facility and selected 16 items, 8 from the support-for-creativity subscale and 8 from the tolerance-for-differences subscale.

We wrote four additional items to assess perceptions of reward-innovation dependency in this environment. These items tapped the degree to which rewards were based on innovative performance, and this subscale overlapped conceptually with performance-reward dependency measures frequently used in the extant literature (e.g., Pritchard & Karasick, 1973). Finally, we wrote six items to assess the degree to which respondents believed resources were adequate for accomplishing the task of innovation. The response scale for the final 26-item measure was a five-point Likert scale ranging from "strongly disagree" to "strongly agree."

The data were submitted to a factor analysis using principal components extraction and varimax rotation. A four-factor solution resulted, and our interpretation of the scree plot suggested that only factor 1 be maintained. However, an examination of the loadings on each factor indicated that the resource items primarily loaded on factors 2, 3, and 4, but most of the items relating to rewards, support for creativity, and tolerance for differences loaded on factor 1. Although factor 1 accounted for only 33.5 percent of the variance, the other three factors accounted for an additional 18.6 percent, and each had an eigenvalue greater than 1.0. In view of this pattern, we conducted a second factor analysis, forcing the items to load on two factors.

In the two-factor solution, two items failed to load over .40 on either factor, and two items loaded over .40 on both factors. We dropped these four items from further analysis. Table 1 shows the final results. Factor 1 (16 items) was named *support for innovation;* it measures the degree to which individuals viewed the organization as open to change, supportive of new ideas from members, and tolerant of member diversity. Factor 2 (6 items), *resource supply,* measures the degree to which resources (i.e., personnel, funding, time) were perceived as adequate in the organization. We treated these factors as separate dimensions of the climate for innovation in the model. Cronbach's alpha for the support for innovation subscale was .92. For the resource supply subscale, it was .77.

Job type was used as a proxy for task type. Interviews with employees and managers at the facility indicated that the technicians' jobs were more structured and routine than the jobs of the engineers and scientists and that the technicians were granted less personal discretion and autonomy in their work. Thus, we dummy-coded technicians as 0 and engineers and scientists as 1, obtaining data from current organizational records.

An individual's *career stage* was measured in terms of two highly correlated, time-based demographic variables, age and R&D tenure, that have been shown to influence innovative behavior (Mumford & Gustafson, 1988). The data were self-reported by study respondents. Since the correlation between the two variables was .80, we calculated a score by standardizing individuals' responses to each of the variables and averaging them. The higher the score, the further along the individual was in his or her career.

Data on *education level,* which has also been suggested to be important to innovation (Mumford & Gustafson, 1988), were obtained by self-report from respondents and coded as follows: high school, 1; some college, 2; associate degree, 3; bachelor's degree, 4; master's degree, 5; and Ph.D. degree, 6.

Assessment of Common Method Variance

A number of the subjective measures used in this study were gathered from the same source in the same questionnaire, which introduced the question of common method variance as a potential explanation for the findings. However, it is common in climate research to assess both perceptions of climate and perceptions of the antecedents of climate in the same questionnaire (e.g., Kozlowski & Doherty, 1989).

Harman's one-factor test (Schriesheim, 1979) was used to empirically address the common method variance issue. If common method variance were a serious problem in the study, we would expect a single factor to emerge from a factor analysis or one general factor to account for most of the

TABLE 1
Factor Structure of the Climate for Innovation Measure[a]

Items	Loadings	
	Factor 1	Factor 2
1. Creativity is encouraged here.	**.66**	.23
2. Our ability to function creatively is respected by the leadership.	**.65**	.34
3. Around here, people are allowed to try to solve the same problems in different ways.	**.52**	.39
4. The main function of members in this organization is to follow orders which come down through channels.[b]	**.73**	.01
5. Around here, a person can get in a lot of trouble by being different.[b]	**.69**	.18
6. This organization can be described as flexible and continually adapting to change.	**.58**	.32
7. A person can't do things that are too different around here without provoking anger.[b]	**.68**	.28
8. The best way to get along in this organization is to think the way the rest of the group does.[b]	**.66**	.25
9. People around here are expected to deal with problems in the same way.[b]	**.69**	.22
10. This organization is open and responsive to change.	**.65**	.36
11. The people in charge around here usually get credit for others' ideas.[b]	**.53**	.03
12. In this organization, we tend to stick to tried and true ways.[b]	**.55**	.36
13. This place seems to be more concerned with the status quo than with change.[b]	**.70**	.34
14. Assistance in developing new ideas is readily available.	.25	**.62**
15. There are adequate resources devoted to innovation in this organization.	.18	**.70**
16. There is adequate time available to pursue creative ideas here.	.12	**.80**
17. Lack of funding to investigate creative ideas is a problem in this organization.[b]	.08	**.53**
18. Personnel shortages inhibit innovation in this organization.[b]	.10	**.55**
19. This organization gives me free time to pursue creative ideas during the workday.	.28	**.64**
20. The reward system here encourages innovation.	**.55**	.31
21. This organization publicly recognizes those who are innovative.	**.59**	.07
22. The reward system here benefits mainly those who don't rock the boat.[b]	**.68**	.21
Eigenvalue	6.97	3.46
Percentage of variance explained	31.67	15.74

[a] Boldface indicates loadings over .40. Associated items were retained in the subscales of the climate for innovation measure.
[b] Item was reverse-coded.

covariance in the independent and criterion variables (Podsakoff & Organ, 1986). We performed a principal components factor analysis on items in the climate measures and the items in the four subjective independent variable measures (leader-member exchange, team-member exchange, and intuitive and systematic problem-solving style), extracting 16 factors, with factor 1 accounting for only 18 percent of the variance. No general factor was apparent in the unrotated factor structure. A varimax rotation failed to converge. The results of this test offer some indication that common method variance was not a problem in this study.

RESULTS

Correlations

Table 2 presents the summary statistics, zero-order correlations, and covariances among the constructs. The bivariate relationships indicate that all the independent variables were significantly related to innovative behavior with the exception of team-member exchange and resource supply. As can be seen, the study variables most highly related to innovative behavior were leader role expectations ($r = .33$, $p < .001$) and systematic problem-solving style ($r = -.29$, $p < .001$). The study variable most highly related to dimensions of climate—support for innovation and resource supply—was leader-member exchange ($r = .53$, $p < .001$ and $r = .33$, $p < .001$, respectively).

Analytic Strategy for Assessing the Model

The analytic strategy used LISREL VI (Jöreskog & Sörbom, 1986). Although LISREL VI provides the capability to assess goodness of fit for overidentified models, it also provides the capability to assess a traditional path model by estimating paths simultaneously. In the current study, the hypothesized model was "just-identified" since each exogeneous variable was hypothesized to directly influence each endogeneous variable. Because the model was just-identified, there were no degrees of freedom available with which to calculate a chi-square goodness-of-fit index. Thus, in the first stage of testing the model, we used LISREL VI in order to obtain maximum likelihood path estimates but not to obtain overall fit measures. In the second stage, we revised the hypothesized model by removing nonsignificant paths. The use of this procedure provided additional degrees of freedom so it was possible to obtain a goodness-of-fit index for the model.

Further, in the present study each latent construct was indicated by only one manifest variable (either a single variable or a composite measure). However, unlike many researchers using only single indicators of latent variables (cf. Fornell, 1983), we did not assume perfect measurement of each variable or scale. Instead, the diagonal entries in the lambda matrix (the loadings from indicator to latent construct) were calculated as the square root of the coefficient-alpha internal consistency estimate for each manifest scale, and the error terms (estimates of random measurement error) were fixed to equal 1.0 minus the value of alpha. This approach draws more traditional methods of assessing reliability into the structural equation modeling arena and follows the procedures recommended by Kenny (1979), James, Mulaik, and Brett (1982), and Williams and Hazer (1986). Netemeyer, Johnston, and Burton (1990) demonstrated that thus combining indicator variables into com-

TABLE 2
Correlations, Covariances, and Descriptive Statistics[a,b]

Variables	Means	s.d.	1	2	3	4	5	6	7	8	9	10	11
1. Innovative behavior	3.20	0.84	.70	.09	−.12	.10	.32	.00	−.27	.15	−.18	.33	.11
2. Support for innovation	3.38	0.74	**.15**	.54	.35	.26	.09	.02	.13	.00	.03	.07	.06
3. Resource supply	2.72	0.82	**−.02**	**.59**	.67	.18	−.04	.04	.19	−.12	.14	−.15	−.05
4. Leader-member exchange	3.72	0.66	**.17**	**.53**	**.33**	.44	.07	.09	.16	.15	.00	.01	.02
5. Role expectations	3.06	1.15	**.33**	**.11**	**−.04**	**.09**	1.31	−.02	−.12	.18	−.11	.67	.24
6. Team-member exchange	3.66	0.53	**.01**	**.04**	**.09**	**.26**	**−.03**	.28	.10	.11	.00	−.12	−.07
7. Systematic problem-solving style	4.32	1.08	**−.29**	**.16**	**.21**	**.22**	**−.09**	**.10**	1.17	−.19	.04	.67	.24
8. Intuitive problem-solving style	5.16	1.02	**.18**	**.00**	**−.14**	**.22**	**.15**	**.20**	**−.17**	1.04	−.06	.34	.06
9. Career stage	0.00	0.95	**−.23**	**.04**	**.18**	**−.01**	**−.10**	**.00**	**.03**	**−.06**	.90	−.43	−.08
10. Education	4.02	1.50	**.26**	**.06**	**−.12**	**.01**	**.39**	**−.15**	**−.17**	**.22**	**−.30**	2.25	.48
11. Job type	0.63	0.49	**.27**	**.16**	**−.12**	**.05**	**.44**	**−.28**	**−.22**	**.13**	**−.16**	**.66**	.24

[a] N = 172; correlations are in boldface type and fill the lower half of the matrix; the variance/covariance matrix occupies the diagonal and upper half of the matrix.

[b] Correlations greater than .13 are significant at .05; those greater than .17, at .01; and those greater than .22, at .001.

posite scales led to path estimates that were virtually identical to the estimates generated by using multiple single-variable indicators.

Four measures in the current study were single-item measures. For the measure of role expectations, the reliability was set at .85, consistent with the 14-month test-retest correlation ($r = .87$) reported previously. The measure of career stage, a composite of age and tenure, and the measure of education were set at .90 and .85, respectively. Finally, the reliability of the task-type measure was set at .90.

The exogeneous variables were allowed to covary in the estimation of the model. That is, we assumed that relationships existed among leader-member exchange, leader role expectations, team-member exchange, intuitive problem-solving style, and systematic problem-solving style.

Evaluating the Hypothesized Model

Table 3 presents the structural parameter estimates for the hypothesized model. Figure 2 presents the final model with nonsignificant paths removed. For the equation predicting innovative behavior, all but two hypothesized parameters were significant. These were the paths from intuitive problem-solving style to innovative behavior and from team-member exchange to innovative behavior. There were significant paths between innovative behavior and each of the other predictors—leader-member exchange, role expectations, systematic problem-solving style, support for innovation, and resource supply—with the covariates entered in the model.

In terms of goodness-of-fit indicators, the model accounted for 37 percent of the variance in innovative behavior. Furthermore, leader-member exchange accounted for 39 percent of the variance in support for innovation, and that variable and intuitive problem-solving style accounted for 29 percent of the variance in resource supply. Further, the assessment of the goodness of fit of the revised model (Figure 2) revealed a quite good fit to the data ($\chi^2 = 23.99$, $df = 16$, $p = .462$). The following values of additional fit indexes also indicated a good fit: goodness-of-fit index, .98, adjusted goodness-of-fit index, .94, and root-mean-square residual, .036.

For the equations predicting the climate dimensions, support for innovation and resource supply, the structural path from leader-member exchange was significant in both cases. In addition, there was a significant relationship between intuitive problem-solving style and resource supply. No support was found for the relationships between role expectations and either climate dimension or for the relationship between team-member exchange and either climate dimension. Finally, there was a significant relationship between the unaccounted variances of the two climate measures ($\lambda_{2,3} = .421$, s.e. $= .074$, $p < .001$), indicating that some unmeasured variable or set of variables similarly influences perceptions of both climate dimensions.

In examining the direction of the significant parameters, we found one relationship that was contrary to hypothesis. Hypothesis 1 predicts a positive relationship between the dimensions of the perceived climate for inno-

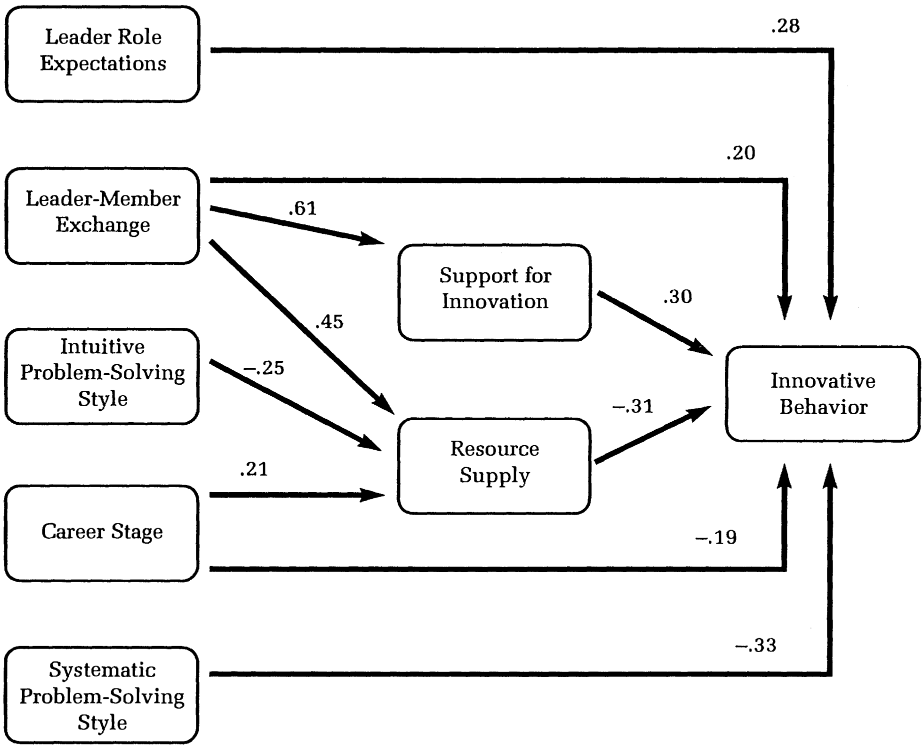
TABLE 3
Standardized Path Estimates

Dependent Variables	Paths	Standardized Path Estimates	s.e.
Innovative behavior	Support → Innovative behavior	.30*	.14
	Resource supply → Innovative behavior	−.31*	.15
	Leader-member exchange → Innovative behavior	.20*	.12
	Role expectations → Innovative behavior	.28**	.08
	Team-member exchange → Innovative behavior	.04	.09
	Systematic problem-solving style → Innovative behavior	−.33***	.09
	Intuitive problem-solving style → Innovative behavior	−.03	.09
	Job type → Innovative behavior	−.07	.14
	Career stage → Innovative behavior	−.19*	.10
	Education → Innovative behavior	.06	.13
Support for innovation	Leader-member exchange → Support	.61***	.08
	Role expectations → Support	.08	.11
	Team-member exchange → Support	−.06	.09
	Systematic problem-solving style → Support	.05	.07
	Intuitive problem-solving style → Support	−.13	.07
	Job type → Support	.17	.11
	Career stage → Support	.06	.08
	Education → Support	−.03	.11
Resource supply	Leader-member exchange → Resources	.45***	.09
	Role expectations → Resources	.09	.09
	Team-member exchange → Resources	−.02	.10
	Systematic problem-solving style → Resources	.08	.09
	Intuitive problem-solving style → Resources	−.25**	.11
	Job type → Resources	−.17	.12
	Career stage → Resources	.21*	.10
	Education → Resources	.11	.14

* $p < .05$
** $p < .01$
*** $p < .001$

vation and innovative behavior. The structural path from support for innovation to innovative behavior offered support for this hypothesis. However, the structural path from resource supply to innovative behavior was negative. The high correlation between the two climate dimensions ($r = .59$, $p < .001$), accompanied by the significant correlation between innovative behavior and support for innovation ($r = .15$, $p < .01$) and the lack of a significant correlation between resource supply and innovative behavior ($r = -.02$, n.s.), suggest suppression was occurring (cf. Cohen & Cohen, 1983; Lord & Novick, 1968). It is likely that resource supply was suppressing some of the variance in support for innovation that was irrelevant to innovative behavior. When this error variance was partialed out, or suppressed, the remaining variance in support for innovation was more strongly related to innovative

FIGURE 2
A Path Model of Individual Innovative Behavior[a]



[a] For clarity, only significant paths are shown

behavior. Our interpretation of the pattern found here is that resource supply was a suppressor variable and was not significantly related to innovative behavior.

In summary, results partially supported Hypothesis 1 in that support for innovation was positively related to innovative behavior and resource supply was not. The significant, positive paths between leader-member exchange and innovative behavior, between leader-member exchange and each of the climate dimensions, and between role expectations and innovative behavior fully supported Hypotheses 2, 3, and 4, respectively. The significant, negative path between systematic problem-solving style and innovative behavior supported Hypothesis 8b. No support was found for Hypothesis 5 (the relationship between role expectations and climate dimensions), Hypothesis 6 (the relationship between team-member exchange and innovative behavior), Hypothesis 7 (the relationship between team-member exchange and climate dimensions), and Hypothesis 8a (the relationship between intuitive problem-solving style and innovative behavior).

The Moderating Effect of Task Type

A single hierarchical moderated regression analysis would typically be used to test for interactive effects between task type and each of the six independent study variables in predicting innovative behavior. However, the inclusion of six multiplicative interactions used substantial degrees of freedom, resulting in relatively low power with which to test for moderator effects. Therefore, we conducted a series of six hierarchical regressions, testing each interaction term in a separate analysis. In each analysis, we entered the covariates, education and career stage, and a single independent variable in step 1. In step 2, the interaction term, job type by the independent variable, was entered. To determine whether moderation was occurring, we tested the change in R^2 from step 1 to step 2 for significance. The results showed that task type moderated only the relationship between role expectations and innovative behavior ($\Delta F_{4,168} = 3.84$, $p < .05$).

To further explore the interaction between task type and innovative behavior, we performed additional analyses by dividing the data set into two subgroups, one composed of engineers and scientists ($N = 108$) and the other composed of technicians ($N = 64$). All of the study predictors were then regressed on innovative behavior for each subgroup. Table 4 shows results. Tests of the significance of the difference between the betas in the two independent subgroups were conducted. Of the six study variables, only the beta for role expectations was significantly different between the two groups. Although the innovative behavior of the technicians was positively related to managers' role expectations ($\beta = .37$, $p < .001$), this relationship was nonsignificant for the engineers and scientists ($\beta = .05$, n.s.).

TABLE 4
Results of Regression Analyses for Subgroups[a]

	Job Type	
Variables	Technicians	Engineers and Scientists
Support for innovation	.26	.26*
Resource supply	−.30	−.13
Leader-member exchange	−.07	.23*
Role expectations[b]	.37***	.05
Team-member exchange	.17	.02
Systematic problem-solving style	−.31**	−.29**
Intuitive problem-solving style	−.06	−.05
Career stage	−.10	−.17
Education	−.10	.11
Adjusted R^2	.24	.23
F	3.90**	3.67**

[a] Column entries are standardized regression coefficients. $N = 64$, technicians; $N = 108$, engineers and scientists.

[b] There is a significant difference in the betas between the two subgroups for the variable.

* $p < .05$; ** $p < .01$; *** $p < .001$.

DISCUSSION

In this study, we developed and tested a model in which leadership, work group relations, and individual attributes were hypothesized to affect individual innovative behavior directly and indirectly, through climate perceptions. We found leadership, support for innovation, managerial role expectations, career stage, and systematic problem-solving style to be significantly related to individual innovative behavior, and the hypothesized model explained almost 37 percent of the variance in innovative behavior. Although our cross-sectional study design precluded making inferences about causality, this is a substantial finding given the limited theory development in this area to date.

The study provides evidence that innovative behavior is related to the quality of the supervisor-subordinate relationship, as Basu (1991) reported in a recent study of blue-collar workers. High-quality dyadic relationships may give subordinates the levels of autonomy and discretion necessary for innovation to emerge (Graen & Scandura, 1987). In addition, the findings support the hypothesis that individuals generalize their supervisor-subordinate relationships to their organizations. In this study, subordinates who reported having relationships with their supervisors characterized by high levels of support, trust, and autonomy also reported the organization to be supportive of innovation and judged the resource supply to be high. The positive relationship found here between leader-member exchange and climate perceptions replicates prior work by Kozlowski and Doherty (1989) and others, and it does so in the context of innovative climate, fulfilling Schneider's (1975) charge that climate studies be anchored within a specific domain of inquiry.

We also found that the role expectations of a supervisor influenced individual innovative behavior, providing support for the Pygmalion effect (Livingston, 1969) within the context of innovation. However, this effect was only operative for the technicians in this study. The innovative behavior of the engineers and scientists was not affected by their managers' role expectations. One explanation for the engineers' and scientists' apparent lack of receptivity to leader role expectations may be their high levels of education and high independence or their having status equality with the managers in this setting (cf. Bass, 1985; Jussim, 1986).

The significant relationship between role expectations and innovative behavior could be the result of common source bias as the managers provided assessments of both variables. However, if method variance resulting from common source and format were a problem, we would expect to find the two variables significantly related to each other in both the engineer-scientist and the technician subgroups. The different patterns of relationship between the subgroups provides some evidence that there was no substantial common source or format similarity bias.

Considering individual attributes, the findings suggest that individuals do not need to be highly intuitive problem solvers to be innovative, but being systematic problem solvers appears to inhibit high levels of innovative behavior. As hypothesized, systematic problem-solving style had a direct negative effect on innovative behavior. This was true both for those engaged in routine tasks (the technicians) and those engaged in nonroutine tasks (the engineers and scientists).

We treated the systematic and intuitive problem-solving styles independently, as prior theory suggests (Jabri, 1991). However, it is likely that the same individuals use systematic and intuitive problem solving at different times and on different tasks. Perhaps the true innovators are people who can use a style that is appropriate to the stage of the innovation cycle in which they are involved. Further study on the implications of the various combinations of these two styles on innovative behavior is needed.

Several findings of the current study were contrary to hypothesis and deserve comment. First, although psychological climate perceptions of support for innovation were positively related to innovative behavior, the coefficient between resource supply and innovative behavior was negative. Given that the zero-order correlation between these two was nonsignificant, it appears that a suppression effect was operating and that there was no relationship between resource supply and innovative behavior. This finding is surprising in that resources have previously been theorized to be critical to innovation (e.g., Lawrence & Dyer, 1983).

One explanation for this finding emerges from the form of the relationships between the climate dimensions and innovative behavior and the nature of the variables themselves. In the case of resources, a threshold effect may operate, whereby perceived increases above some point have no further effect in facilitating innovative behavior. Since the data in this study were from an R&D laboratory with the espoused mission of innovation, resource levels are likely to have been consistently above such a threshold. Thus, no relationship was found between resources and innovative behavior in this study. Cross-organizational research at the individual level is needed to broaden the range of the resource supply variable and test for threshold effects.

In contrast to the resource supply variable, support for innovation was positively related to innovative behavior. If a threshold effect exists for the support variable, this organization may have operated below the threshold level and thus, a positive linear relationship was found. Alternatively, it may be that the support variable is very different from the resource variable. Support for innovation, as defined here, measures abstract concepts—flexibility, encouragement, tolerance for change—that may, in fact, be linearly related to behavior across the entire range. In other words, more support may always be better than less. Further, it is likely that the dimensions of climate exist on a hierarchy of need. Support for innovation may only influence innovative behavior once the need for some threshold level of resources is met.

Finally, in this study innovative climate perceptions only mediated between leader-member exchange and innovative behavior. Although the findings relative to leader-member exchange have significance for management practice, the general lack of support for climate as a mediator in the determination of innovative behavior was surprising. The role of climate as a mediator may be overstated in the literature, at least as it relates to innovative behavior. We were not able to identify individual or work group characteristics that engendered differences in climate perceptions in this study; neither problem-solving style nor team-member exchange were related to innovative climate perceptions here. Indeed, the findings suggest that it would be more effective in future research to search for additional direct antecedents to innovative behavior rather than antecedents whose effects are mediated by innovative climate perceptions.

Surprisingly, team-member exchange was not related to innovative behavior or to climate perceptions in this study. A possible explanation for these seemingly implausible findings is that intragroup task interdependence may mediate the relationship between team-member exchange and both affective and behavioral responses. Where task interdependence and work-group-member interaction is low, the relationship between measures of work group cooperation and collaboration is likely to be weaker than it will be when task interdependence and member interaction is high; indeed, the relationship may be nonexistent. Future studies of work group effects on innovative behavior should include measures of task interdependence.

The findings in this study are subject to a number of caveats. First, the cross-sectional research design limits the ability to determine causation. In fact, previous researchers have conceptualized the relationship between leader-member exchange and performance outcomes and between leader role expectations and performance outcomes as reciprocal (Eden, 1984; Graen & Scandura, 1987). Future studies should include longitudinal designs to further explore the reciprocality of many of the relationships posited in this study.

The second caveat concerns the generalizability of these findings to other types of work organizations and to other functional areas of organizations. Although a number of the hypothesized relationships replicate the work of others in very different settings, the test of the overall model should be replicated in other settings. This study focused on self-managing professionals in R&D; future studies should examine a broader range of tasks and technologies as potential boundary conditions of the model.

Monomethod bias was minimized as much as possible in this study, but it must be noted that it remains an issue. Although we took care to assure that items in the measures of the predictors of climate tapped separate conceptual domains, all the measures used similar response formats and were completed by the same sources. However, we generally avoided the same-source responses in assessing the determinants of innovative behavior. The criterion was a supervisory assessment of innovative behavior, but measures of the independent variables were assessed by subordinates or from archives, with the exception of role expectations.

The current study provides a first attempt at modeling a complex phenomenon—individual innovative behavior. There has been no scarcity in the literature of suggested antecedents to individual creativity and innovation; we attempted to integrate some of these disaggregated findings into a cohesive whole and tested them in the natural work context of an R&D facility. Our study thus provides some understanding of the complex relationships among and causal paths between a number of antecedents often cited in previous work. Although the findings reported here provide some guidance to practicing managers, they also pose a whole new set of questions for researchers. What is the joint effect of systematic and intuitive problem-solving styles? Is there a threshold level at which additional resources no longer improve innovative behavior? Is this threshold effect common to all types of resources—time as well as equipment and facilities? Will additional support for innovation continue to improve innovative behavior, and to what level? How do task type and technology moderate the relationships reported here? The answers to these questions await further study.

Studying individual innovative behavior in a natural work context is a complex and difficult task because the criterion is often difficult to validate, and researchers are often limited to the use of perceptual measures. But as organizations face increasingly turbulent environments and innovation becomes part of every employees' job description, the need for this kind of research is ever increasing.

REFERENCES

Abbey, A., & Dickson, J. 1983. R&D work climate and innovation in semiconductors. ***Academy of Management Journal,*** 26: 362–368.

Amabile, T. 1988. A model of creativity and innovation in organizations. In B. M. Staw & L. L. Cummings (Eds.), ***Research in organizational behavior,*** vol. 10: 123–167. Greenwich, CT: JAI Press.

Amabile, T., & Gryskiewicz, S. 1987. ***Creativity in the R&D laboratory.*** Technical report no. 30, Center for Creative Leadership, Greensboro, NC.

Amabile, T., & Gryskiewicz, N. 1989. The creative environment scales: The Work Environment Inventory. ***Creativity Research Journal,*** 2: 231–254.

Ancona, D., & Caldwell, D. 1987. Management issues facing new product teams in high technology companies. In D. Lewin, D. Lipsky, & D. Sokel (Eds.), ***Advances in industrial and labor relations,*** vol. 4: 191–221. Greenwich, CT: JAI Press.

Angle, H. 1989. Psychology and organizational innovation. In A. Van de Ven, H. Angle, & M. Poole (Eds.), ***Research on the management of innovation: The Minnesota studies:*** 135–170. New York: Harper & Row.

Ashforth, B. 1985. Climate formation: Issues and extensions. ***Academy of Management Review,*** 10: 837–847.

Bandura, A. 1988. Self-regulation of motivation and action through goal systems. In V. Hamilton, F. H. Bower, & N. H. Frijda (Eds.), ***Cognitive perspectives on emotion and motivation:*** 37–61. Dordrecht, Netherlands: Lkuwer Academic Publishers.

Barron, F., & Harrington, D. 1981. Creativity, intelligence, and personality. In M. R. Rosenzweig & L. W. Porter (Eds.), ***Annual review of psychology,*** 32: 439–476. Palo Alto, CA: Annual Reviews.

Bass, B. 1985. Leadership: Good, better, best. ***Organizational Dynamics,*** 14(3): 26–40.

Basu, R. 1991. ***An empirical examination of leader-member exchange and transformational leadership as predictors of innovative behavior.*** Unpublished doctoral dissertation, Purdue University, West Lafayette, IN.

Cohen, J., & Cohen, P. 1983. ***Applied multiple regression/correlation analysis for the behavioral sciences.*** Hillsdale, NJ: Erlbaum.

Cotgrove, S., & Box, S. 1970. ***Science, industry, and society: Studies in the sociology of science.*** London: George Allen & Unwin.

Dansereau, F., Graen, G., & Haga, W. 1975. A vertical dyad linkage approach to leadership within formal organizations: A longitudinal investigation of the role-making process. ***Organizational Behavior and Human Performance,*** 13: 46–78.

Dunegan, K., Tierney, P., & Duchon, D. 1992. Toward an understanding of innovative climate: Explaining variance in perceptions by divisional affiliation, work group interactions, and subordinate-manager exchanges. ***IEEE Transactions on Engineering Management,*** 39 (special issue): 227–236.

Eden, D. 1984. Self-fulfilling prophesy as a management tool: Harnessing Pygmalion. ***Academy of Management Review,*** 91: 64–73.

Eiter, M. 1991. ***The influence of cognitive schemas on perceptions of organizational climate.*** Paper presented at the 51st Annual Meeting of the Academy of Management, Miami.

Festinger, L. 1954. A theory of social comparison processes. ***Human Relations,*** 7: 114–140.

Fornell, C. 1983. Issues in the application of covariance structure analysis: A comment. ***Journal of Consumer Research,*** 9: 443–448.

Glick, W. 1985. Conceptualizing and measuring organizational and psychological climate: Pitfalls in multilevel research. ***Academy of Management Review,*** 10: 601–616.

Glick, W. 1988. Response: Organizations are not central tendencies: Shadowboxing in the dark, round 2. ***Academy of Management Review,*** 13: 133–137.

Graen, G., & Cashman, J. 1975. A role-making model of leadership in formal organizations: A developmental approach. In J. Hunt & L. Larson (Eds.), ***Leadership frontiers:*** 309–357. Kent, OH: Kent State University Press.

Graen, G., Novak, M., & Sommerkamp, P. 1982. The effects of leader-member exchange and job design on productivity and job satisfaction: Testing a dual attachment model. ***Organizational Behavior and Human Performance,*** 30: 109–131.

Graen, G., & Scandura, T. 1987. Toward a psychology of dyadic organizing. In L. L. Cummings & B. M. Staw (Eds.), ***Research in organizational behavior,*** vol. 9: 175–208. Greenwich, CT: JAI Press.

Isaksen, S. 1987. An orientation to the frontiers of creativity research. In S. Isaksen (Ed.), ***Frontiers of creativity research: Beyond the basics:*** 1–31. Buffalo: Bearly Limited.

Isaksen, S., & Kaufmann, G. 1990. Adaptors and innovators: Different perspectives of the psychological climate for creativity. ***Studia Psychologica,*** 32: 129–140.

Jabri, M. 1991. The development of conceptually independent subscales in the measurement of modes of problem solving. ***Educational and Psychological Measurement,*** 51: 975–983.

James, L., Hater, J., Gent, M., & Bruni, J. 1978. Psychological climate: Implications from cognitive social learning theory and interactional psychology. ***Personnel Psychology,*** 31: 783–813.

James, L., Hartman, E., Stebbins, M., & Jones, A. 1977. An examination of the relationship between psychological climate and a VIE model for work motivation. ***Personnel Psychology,*** 30: 229–254.

James, L., James, L., & Ashe, D. 1990. The meaning of organizations: The role of cognition and values. In B. Schneider (Ed.), ***Organizational climate and culture:*** 40–84. San Francisco: Jossey-Bass.

James, L., Mulaik, S., & Brett, J. 1982. ***Causal analysis: Assumptions, models, and data.*** Beverly Hills: Sage.

James, L., & Sells, S. 1981. Psychological climate: Theoretical perspectives and empirical research. In D. Magnussen (Ed.), ***Toward a psychology of situations: An interactional perspective:*** 275–295. Hillsdale, NJ: Erlbaum.

Jones, A., & James, L. 1979. Psychological climate: Dimensions and relationships of individual and aggregated work environment perceptions. ***Organizational Behavior and Human Performance,*** 23: 210–233.

Jöreskog, K., & Sörbom, D. 1986. ***LISREL VI: Analysis of linear structural relationships by maximum likelihood, instrumental variables, and least squares methods.*** Department of Statistics, University of Uppsala, Uppsala, Sweden.

Jussim, L. 1986. Self-fulfilling prophesies: A theoretical and integrative review. ***Psychological Review,*** 93: 429–445.

Kanter, R. 1983. ***The change masters.*** New York: Simon & Schuster.

Kanter, R. 1988. When a thousand flowers bloom: Structural, collective, and social conditions for innovation in organizations. In B. M. Staw & L. L. Cummings (Eds.), ***Research in organizational behavior,*** vol 10: 169–211. Greenwich, CT: JAI Press.

Kenny, D. 1979. ***Correlation and causality.*** New York: Wiley-Interscience.

Kirton, M. 1976. Adaptors and innovators: A description and measure. ***Journal of Applied Psychology,*** 61: 622–629.

Koestler, A. 1964. ***The act of creation.*** London: Hutchinson.

Kozlowski, S., & Doherty, M. 1989. Integration of climate and leadership: Examination of a neglected topic. ***Journal of Applied Psychology,*** 74: 546–553.

Lawrence, P., & Dyer, P. 1983. ***Renewing American industry.*** New York: Free Press.

Lewin, K. 1938. ***The conceptual representation of the measurement of psychological forces.*** Durham, NC: Duke University Press.

Livingston, J. 1969. Pygmalion in management. ***Harvard Business Review,*** 47(4): 81–89.

Lord, R., & Novick, M. 1968. ***Statistical theories of mental test scores.*** Reading, MA: Addison-Wesley.

Middlemist, R., & Hitt, M. 1981. Technology as a moderator of the relationship between perceived work environment and subunit effectiveness. ***Human Relations,*** 34: 517–532.

Mumford, M., & Gustafson, S. 1988. Creativity syndrome: Integration, application, and innovation. ***Psychological Bulletin,*** 103: 27–43.

Netemeyer, R., Johnston, M., & Burton, S. 1990. Analysis of role conflict and role ambiguity in a structural equations framework. ***Journal of Applied Psychology,*** 75: 148–157.

Paolillo, J., & Brown, W. 1978. How organizational factors affect R&D innovation. ***Research Management,*** 21: 12–15.

Payne, R., Lane, D., & Jabri, M. 1990. A two dimensional person-environment fit analysis of the performance, effort, and satisfaction of research scientists. ***British Journal of Management,*** 1: 45–57.

Pelz, D., & Andrews, F. 1966. Autonomy, coordination, and stimulation in relation to scientific achievement. ***Behavioral Science,*** 11: 89–97.

Podsakoff, P., & Organ, D. 1986. Self-reports in organizational research: Problems and prospects. ***Journal of Management,*** 12: 531–544.

Pritchard, R., & Karasick, B. 1973. The effects of organizational climate on managerial job performance and satisfaction. ***Organizational Behavior and Human Performance,*** 9: 126–146.

Rogers, C. 1954. Toward a theory of creativity. ***Review of General Semantics,*** 2: 249–260.

Schneider, B. 1975. Organizational climates: An essay. ***Personnel Psychology,*** 28: 447–479.

Schneider, B., & Reichers, A. 1983. On the etiology of climates. ***Personnel Psychology,*** 36: 19–39.

Schriesheim, C. 1979. The similarity of individual directed and group directed leader behavior descriptions. ***Academy of Management Journal,*** 22: 345–355.

Schroeder, R., Van de Ven, A., Scudder, G., & Polley, D. 1989. The development of innovation ideas. In A. Van de Ven, H. Angle, & M. Poole (Eds.), ***Research on the management of innovation: The Minnesota studies:*** 107–134. New York: Harper & Row.

Seers, A. 1989. Team-member exchange quality: A new construct for role-making research. ***Organizational Behavior and Human Decision Processes,*** 43: 118–135.

Sethia, N. 1991. ***The evocation of creativity through collaboration.*** Paper presented at the annual meeting of the Academy of Management, Miami.

Siegel, S., & Kaemmerer, W. 1978. Measuring the perceived support for innovation in organizations. ***Journal of Applied Psychology,*** 63: 553–562.

Taylor, C. 1963. Variables related to creativity and productivity in men in two research laboratories. In C. Taylor & R. Barron (Eds.), ***Scientific creativity: Its recognition and development:*** 513–597. New York: Wiley.

Van de Ven, A. 1986. Central problems in the management of innovation. ***Management Science,*** 32: 590–607.

Waldman, D., & Bass, B. 1991. Transformational leadership at different phases of the innovation process. ***Journal of High Technology Management Research,*** 2: 169–180.

Walton, R. 1985. Transformation of workforce strategies in the United States. In K. Clark, R. Hayes, & C. Lorenz (Eds.), ***The uneasy alliance: Managing the productivity-technology dilemma:*** 237–265. Boston: Harvard Business School.

West, M., & Farr, J. 1989. Innovation at work: Psychological perspectives. ***Social Behavior,*** 4: 15–30.

West, M., & Farr, J. 1990. Innovation at work. In M. West & J. Farr (Eds.), ***Innovation and creativity at work: Psychological and organizational strategies:*** 3–13. New York: Wiley.

Williams, L., & Hazer, J. 1986. Antecedents and consequences of satisfaction and commitment in turnover models: A reanalysis using latent variable structural equation methods. ***Journal of Applied Psychology,*** 71: 219–231.

Woodman, R., Sawyer, J., & Griffin, R. 1993. Toward a theory of organizational creativity. ***Academy of Management Review,*** 18: 293–321.

APPENDIX
Innovative Behavior Measure

Instructions to respondents were as follows:

"Innovation is a process involving both the generation and implementation of ideas. As such, it requires a wide variety of specific behaviors on the part of individuals. While some people might be expected to exhibit all the behaviors involved in innovation, others may exhibit only one or a few types of behavior. Please rate each of your subordinates on the extent to which he or she:

1. Searches out new technologies, processes, techniques, and/or product ideas.
2. Generates creative ideas.
3. Promotes and champions ideas to others.
4. Investigates and secures funds needed to implement new ideas.
5. Develops adequate plans and schedules for the implementation of new ideas.
6. Is innovative."

Susanne G. Scott received her Ph.D. degree in management from the University of Cincinnati. She is an assistant professor of management at the University of Colorado at Colorado Springs. Her current research interests include processes of change and innovation at the individual, group, and organizational levels, empowerment, teamwork, workforce diversity, and decision making.

Reginald A. Bruce received his Ph.D. degree in organizational psychology from the University of Michigan. He is an assistant professor of management in the College of Business and Public Administration at the University of Louisville. His current research interests include individual adjustment to role and career changes, the transition from unemployment to employment, decision-making styles, and innovation.