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ASSESSING THE WORK ENVIRONMENT FOR CREATIVITY

TERESA M. AMABILE
Harvard University
REGINA CONTI
Colgate University
HEATHER COON
University of Michigan
JEFFREY LAZENBY
University of Southern California
MICHAEL HERRON
Personnel Decisions International

We describe the development and validation of a new instrument, KEYS: Assessing the Climate for Creativity, designed to assess perceived stimulants and obstacles to creativity in organizational work environments. The KEYS scales have acceptable factor structures, internal consistencies, test-retest reliabilities, and preliminary convergent and discriminant validity. A construct validity study shows that perceived work environments, as assessed by the KEYS scales, discriminate between high-creativity projects and low-creativity projects; certain scales discriminate more strongly and consistently than others. We discuss the utility of this tool for research and practice.

All innovation begins with creative ideas. Successful implementation of new programs, new product introductions, or new services depends on a person or a team having a good idea—and developing that idea beyond its initial state. Departing from the traditional psychological approach to creativity, which focuses on the characteristics of creative persons (e.g., Barron, 1955; MacKinnon, 1965), we assume that the social environment can influ-

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ence both the level and the frequency of creative behavior. Like other researchers (e.g., Stein, 1974; Woodman, Sawyer, & Griffin, 1993), we define creativity as the production of novel and useful ideas in any domain. We define innovation as the successful implementation of creative ideas within an organization. In this view, creativity by individuals and teams is a starting point for innovation; the first is a necessary but not sufficient condition for the second. Successful innovation depends on other factors as well, and it can stem not only from creative ideas that originate within an organization but also from ideas that originate elsewhere (as in technology transfer).

This article focuses on the intraorganizational foundations of innovation—creative project work by teams of individuals. It examines the psychological *context of creativity,* the work environment perceptions that can influence the creative work carried out in organizations. In two senses, the article addresses both creativity and innovation: Creativity is the seed of all innovation, and psychological perceptions of innovation (the implementation of people's ideas) within an organization are likely to impact the motivation to generate new ideas. Although there has been much theoretical work, and some empirical work, on the context of creativity over the past several years, there has been no reliable, valid method for adequately assessing the various work environment dimensions proposed to play a role. The instrument described in this paper, *KEYS: Assessing the Climate for Creativity* (formerly, *Work Environment Inventory*), and the conceptual model underlying it, were developed to serve that function. KEYS was designed to assess perceptions of all of the work environment dimensions that have been suggested as important in empirical research and theory on creativity in organizations.

BACKGROUND

Related Instruments

Few scholars have attempted to quantitatively assess the work environment for creativity, although there are some psychometrically sound instruments that assess perceptions of organizational environments in general. For example, the Organization Assessment Instrument (OAI; Van de Ven & Ferry, 1980) provides a reliable, valid, and comprehensive assessment of an organization's design, structures, and functions (Drazin & Van de Ven, 1985). The Work Environment Scale (WES; Insel & Moos, 1975) assesses employees' perceptions of several broad dimensions of their daily work environments. However, neither of these instruments specifically focuses on the organizational environment for creativity. Indeed, only one psychometric instrument designed for this purpose (besides KEYS) has been documented in the scholarly literature.[1] The Siegel Scale of Support of Innovation (Siegel

[1] An instrument that appears similar in many ways to KEYS, the Creative Climate Questionnaire (CCQ), was developed in Swedish by Ekvall and his colleagues (Ekvall, Arvonen, & Waldenstrom-Lindblad, 1983). Although considerable data on Swedish companies have been

& Kaemmerer, 1978) assesses perceptions of leadership, ownership, norms for diversity, continuous development, and consistency. However, because the instrument was validated on school teachers and students, its utility in business organizations is uncertain. We developed KEYS because we believe that, for organizational theory, research, and practice, an instrument based in the organizational literature and tested in organizational settings is most appropriate.

Related Theories

Recent contextual theories of organizational creativity and innovation have attempted to identify dimensions of work environments that are related to creativity. In the componential model of creativity and innovation in organizations (Amabile, 1988), three broad organizational factors are proposed, each of which includes several specific elements: (1) *Organizational motivation to innovate* is a basic orientation of the organization toward innovation, as well as supports for creativity and innovation throughout the organization. (2) *Resources* refers to everything that the organization has available to aid work in a domain targeted for innovation (e.g., sufficient time for producing novel work in the domain, and the availability of training. (3) *Management practices* refers to allowance of freedom or autonomy in the conduct of work, provision of challenging, interesting work, specification of clear overall strategic goals, and formation of work teams by drawing together individuals with diverse skills and perspectives. The conceptual model underlying the development of KEYS is a more detailed and specific articulation of this componential theory.

Woodman, Sawyer, and Griffin (1993) took a similar theoretical perspective on creativity in organizations, but they extended their model in two additional ways. They included external influences as well as intraorganizational influences, and they gave prominence to intraindividual factors in their interactionist approach. In their model, creative behavior within organizations is a function of two categories of work environment inputs (inputs beyond the characteristics of the individual people involved in doing the work): (1) *Group characteristics* are the norms, group cohesiveness, size, diversity, roles, task characteristics, and problem-solving approaches used in the group. (2) *Organizational characteristics* consist of organizational culture, resources, rewards, strategy, structure, and focus on technology. KEYS also taps many of these aspects of the work environment.

Issues in the Assessment of Organizations

Most organizations are composed of a number of individuals working within various hierarchical groupings. In an R&D organization, for example, small teams of scientists and engineers might undertake product develop-

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collected with this instrument, its psychometric properties have not been documented in the scholarly literature.

ment projects; these teams might be led by project managers, who will be supervised by lab heads, who will report to division heads, who will in turn report to corporate executives. What *is* the work environment of such an organization? Is there one work environment, or many? What do self-report responses on perceptions of the work environment really measure?

In her seminal work on cultures and subcultures within organizations, Sackmann (1992) found that, although some aspects of an organization's environment can be considered homogeneous, other aspects can differ considerably across subgroups within the organization. Using quite different methods, Gersick found that the success or failure of a work team depends greatly upon the context or environment of the group, which is fashioned, in large part, by "the design and designer of the group" (1988: 35). Because both the design and the designer of a group can vary substantially even within the same organization, Gersick's findings and theoretical model suggest that different teams within an organization might experience quite different work environments. Moreover, in their theoretical and empirical work on the assessment of organizations, Van de Ven and Ferry (1980) proposed that subunits of a given organization can vary significantly in their effectiveness, their daily functioning, and the reactions that employees have to working within them. Thus, we assume that, although meaningful interorganizational differences should be expected on work environment dimensions, there will often also be meaningful intraorganizational differences between divisions, departments, and work groups. Furthermore, it might be assumed that even organization-wide elements, such as top management directives, might be perceived somewhat differently by different groups within an organization.

Previous creativity research on social-environmental influences in organizations has uncovered aspects of the work environment at the level of the organization, the level of project management, and the level of the work group itself. Although *influences* on work environment perceptions can arise at several different levels within an organization, KEYS and the model underlying it focus on *individuals' perceptions* and the influence of those perceptions on the creativity of their work. The underlying assumption is that self-report responses on a work environment questionnaire reveal respondents' perceptions—the psychological meaning that respondents attach to events in their organizations, their organizational units, and their work groups. Thus, the level at which the source of influence operates is less important than the perceptions themselves and their relation to creativity. Accordingly, this psychological model and the accompanying psychological instrument take the "total-work-environment level of analysis" approach outlined by Pierce and his colleagues (Pierce, Gardner, Cummings, & Dunham, 1989). For example, whether individuals feel their co-workers, their supervisors, or their high-level superiors encourage them to take risks in their project work, what is important is the fact that they perceive such encouragement. Thus, KEYS and its underlying model include perceptions of influences at several levels within the organization.

Because the model and the instrument are psychological in nature, focusing on perceptions, the correspondence to actual objectifiable aspects of the work environment need not be direct. According to contextual theories of organizational creativity, it is the psychological meaning of environmental events that largely influences creative behavior (e.g., Amabile, 1988; Woodman et al., 1993). Clearly, there must be some correspondence between organizational reality and work environment perceptions as assessed by KEYS, or the instrument would assess only individual personalities and would reveal nothing of use to managers. But rather than attempt to quantify actual events in the work environment, we focus on the work environment perceptions of project team members and the relationship between those perceptions and the creativity of the project outcomes. Once reliable relationships between work environment perceptions and the creativity of the work being done are established, we can embark on future research to determine the precise connections between events and perceptions.

CONCEPTUAL MODEL

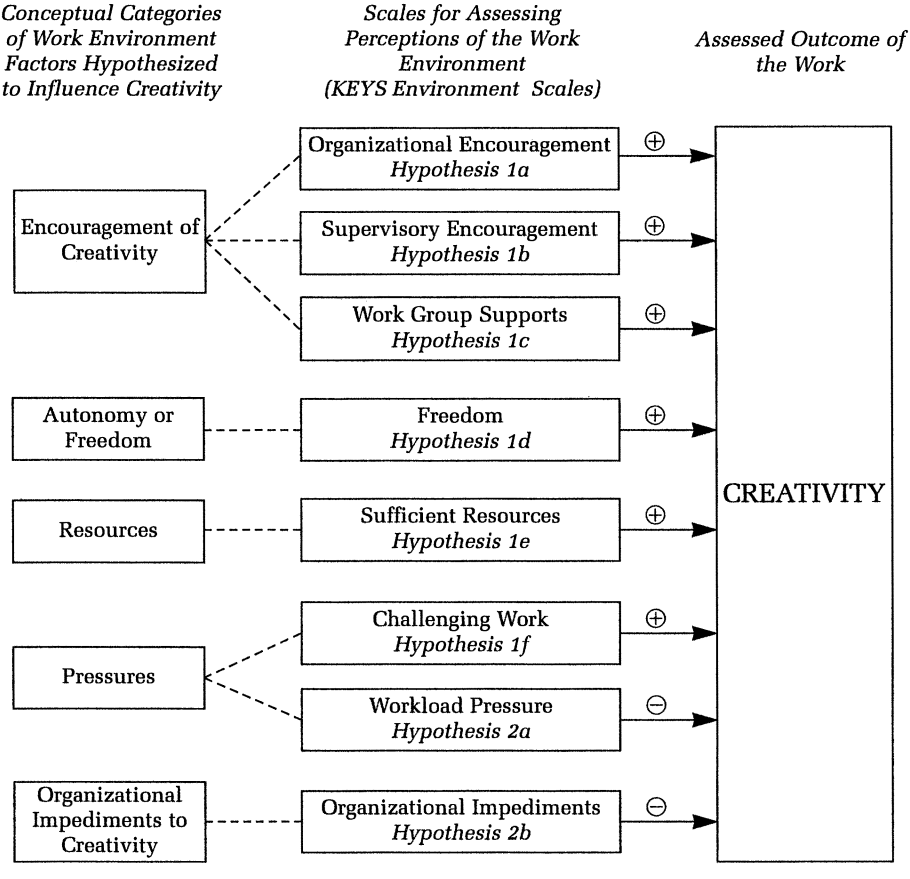
Figure 1 depicts the conceptual model underlying KEYS. This figure includes the major conceptual categories of the model, specifying the KEYS scales that grew from each category and noting the predicted relationship between each scale and assessed creativity. The scales predicted to be positively related to creativity are referred to as "stimulant scales" and those predicted to be negatively related are referred to as "obstacle scales." The conceptual categories were developed from two primary sources. The first was a review of previous research. The second was a critical-incidents study in which 120 R&D scientists and technicians were asked to describe a high-creativity event from their work experience as well as a contrasting low-creativity event (Amabile, 1988; Amabile & Gryskiewicz, 1987). Independent raters coded transcriptions of these interviews; the work environment descriptors that were mentioned frequently by the interviewees fall into the conceptual categories in the model.

The conceptual categories are described here beginning with the most frequently mentioned findings and ending with those that have appeared only rarely in the previous literature. Within each category, psychological mechanisms underlying the hypothesized effect on creative behavior are briefly described. Many of these mechanisms derive from the intrinsic motivation principle of creativity: People will be most creative when they are primarily intrinsically motivated, by the interest, enjoyment, satisfaction, and challenge of the work itself; this intrinsic motivation can be undermined by extrinsic motivators that lead people to feel externally controlled in their work (Amabile, 1983, 1988, 1993).

Encouragement of Creativity

This dimension is, by far, the broadest and the most frequently mentioned in the literature. Encouragement of the generation and development

FIGURE 1
Conceptual Model Underlying Assessment of Perceptions of the Work Environment for Creativity[a]



[a] The scales predicted to be positively related to creativity are referred to as "stimulant scales" and those predicted to be negatively related are referred to as "obstacle scales."

of new ideas appears to operate at three major levels within organizations. The first of these, organizational encouragement, appears prominently in the literature; the other two (supervisory encouragement and work group encouragement) are less frequently mentioned.

Organizational encouragement. Several aspects are perceived as operating broadly across the organization: (1) The first is encouragement of risk taking and of idea generation, a valuing of innovation from the highest to the lowest levels of management (Cummings, 1965; Delbecq & Mills, 1985; Ettlie, 1983; Hage & Dewar, 1973; Kanter, 1983; Kimberley & Evanisko, 1981). Psychological research on creativity has demonstrated that people are more

likely to produce unusual, useful ideas if they are given license to do so by the situation or by explicit instructions (Parnes, 1964; Parnes & Meadow, 1959). (2) Fair, supportive evaluation of new ideas (Cummings, 1965; Kanter, 1983) is the second aspect of organizational encouragement. The expectation of threatening, highly critical evaluation has been shown to undermine creativity in laboratory studies (Amabile, 1979; Amabile, Goldfarb, & Brackfield, 1990). Moreover, field experiments have demonstrated that supportive, informative evaluation can enhance the intrinsically motivated state that is most conducive to creativity (Deci & Ryan, 1985). (3) Reward and recognition of creativity (Abbey & Dickson, 1983; Cummings, 1965; Paolillo & Brown, 1978) is the third aspect of organizational encouragement. Although engaging in an activity only to obtain a contracted-for reward can undermine creativity (Amabile et al., 1986), creativity can be enhanced by expecting a reward that is perceived as a "bonus," a confirmation of one's competence, or a means of enabling one to do better, more interesting work in the future (Amabile et al., 1986; Amabile, Phillips, & Collins, 1993; Hennessey, Amabile, & Martinage, 1989). (4) Finally, collaborative idea flow across an organization and participative management and decision making (Allen, Lee, & Tushman, 1980; Kanter, 1983; Kimberley & Evanisko, 1981; Monge, Cozzens, & Contractor, 1992; Zaltman, Duncan, & Holbeck, 1973) are important aspects of organizational encouragement. Creativity research has shown that the probability of creative idea generation increases as exposure to other potentially relevant ideas increases (Osborn, 1963; Parnes & Noller, 1972).

Supervisory encouragement. Several studies have pointed to the role of project managers or direct supervisors, particularly in the areas of (1) goal clarity (Bailyn, 1985), (2) open interactions between supervisor and subordinates (Kimberley, 1981; Kimberley & Evanisko, 1981), and (3) supervisory support of a team's work and ideas (Delbecq & Mills, 1985; Orpen, 1990). The results of research demonstrating the critical role of problem definition in the creative process (Getzels & Csikszentmihalyi, 1976) imply the importance of goal clarity in creative behavior. It is likely that open supervisory interactions and perceived supervisory support operate on creativity largely through the same mechanisms that are associated with fair, supportive evaluation; under these circumstances, people are less likely to experience the fear of negative criticism that can undermine the intrinsic motivation necessary for creativity (Amabile, 1979, 1983).

Work group encouragement. As a few studies have revealed, encouragement of creativity can occur within a work group itself, through diversity in team members' backgrounds, mutual openness to ideas, constructive challenging of ideas, and shared commitment to the project (Albrecht & Hall, 1991; Andrews, 1979; Monge, Cozzens, & Contractor, 1992; Payne, 1990). Team member diversity and mutual openness to ideas may operate on creativity by exposing individuals to a greater variety of unusual ideas; such exposure has been demonstrated to positively impact creative thinking (Parnes & Noller, 1972). Constructive challenging of ideas and shared commit-

ment to a project are likely to yield increases in intrinsic motivation, because two of the primary features of intrinsic motivation are a positive sense of challenge in the work and a focus on the work itself (Amabile, Hill, Hennessey, & Tighe, 1994; Harter, 1978; White, 1959).

Freedom/Autonomy

Several researchers have concluded that creativity is fostered when individuals and teams have relatively high autonomy in the day-to-day conduct of the work and a sense of ownership and control over their own work and their own ideas (Bailyn, 1985; King & West, 1985; Paolillo & Brown, 1978; Pelz & Andrews, 1966; West, 1986). Studies of creativity have revealed that individuals produce more creative work when they perceive themselves to have choice in how to go about accomplishing the tasks that they are given (e.g., Amabile & Gitomer, 1984).

Resources

A number of researchers have suggested that resource allocation to projects is directly related to the projects' creativity levels (Cohen & Levinthal, 1990; Damanpour, 1991; Delbecq & Mills, 1985; Farr & Ford, 1990; Kanter, 1983; Payne, 1990; Tushman & Nelson, 1990). Aside from the obvious practical limitations that extreme resource restrictions place on what people can accomplish in their work, perceptions of the adequacy of resources may affect people psychologically by leading to beliefs about the intrinsic value of the projects that they have undertaken.

Pressures

Few studies have produced findings relevant to the question of the effects of pressure on creativity in organizations. The evidence that does exist suggests seemingly paradoxical influences. Some research has found that, although workload pressures that were considered extreme could undermine creativity, some degree of pressure could have a positive influence if it was perceived as arising from the urgent, intellectually challenging nature of the problem itself (Amabile, 1988; Amabile & Gryskiewicz, 1987). Similarly, Andrews and Farris (1972) found that time pressure was generally associated with high creativity in R&D scientists, except when that pressure reached an undesirably high level. We conceptualize these findings as identifying two distinct forms of pressure, excessive *workload pressure,* and *challenge;* the first should have a negative influence on creativity, and the second should have a positive influence. Psychological research suggests that exploration of alternative possibilities and time for that exploration directly correlate with the creativity of task outcomes in laboratory settings (Conti, Coon, & Amabile, 1993; Parnes, 1961; Ruscio, Whitney, & Amabile, 1995; Whitney, Ruscio, Amabile, & Castle, 1995). Thus, excessive workload pressure would be expected to undermine creativity, especially if that time pressure were perceived as imposed externally as a means of control (Am-

abile, 1993). But time pressure that is perceived as a necessary concomitant of an important, urgent project may add to the perception of challenge in the work that positively correlates with intrinsic motivation and creativity (Amabile, 1988).

Organizational Impediments to Creativity

Although there is little evidence beyond the critical-incidents study cited earlier (Amabile, 1988; Amabile & Gryskiewicz, 1987), some research suggests that internal strife, conservatism, and rigid, formal management structures within organizations will impede creativity (Kimberley, 1981; Kimberley & Evanisko, 1981). Because individuals are likely to perceive each of these factors as controlling, they may lead to increases in individuals' extrinsic motivation, and corresponding decreases in the intrinsic motivation that is necessary for creativity (Amabile, 1988; Deci & Ryan, 1985).

This brief review makes it clear that, in most previous research on the work environment for creativity, there has been a bias toward creativity supports—work environment factors that appear to enhance creativity. There is comparatively little research evidence on creativity impediments—work environment factors that may undermine creativity. Indeed, aside from the critical-incidents study that specifically probed for negative influences (Amabile & Gryskiewicz, 1987), only two studies have highlighted creativity obstacles (Kimberley, 1981; Kimberley & Evanisko, 1981). In developing the conceptual model depicted in Figure 1, and in developing KEYS to fit the components of that model, we attempted to include all work environment dimensions that might be important for creativity, including both negative and positive influences.

RESEARCH APPROACH

KEYS (Amabile, 1995) was designed to provide reliable and valid assessments of aspects of organizational work environment perceptions that are likely to influence the generation and development of creative (i.e., novel and useful) ideas. Its items were written to address all positive and negative aspects of the work environment described in the literature. KEYS was intended to serve as a tool for research and theory development, particularly for scholars interested in understanding contextual influences on creative behavior in work organizations. Specifically, scholars who use this tool in their research should be able to gain more detailed insight into the ways in which work environment perceptions can influence the creativity level of project outcomes. KEYS was also intended to serve as a tool for practitioners interested in diagnosing the degree to which an organization's work environment fosters creative work in individuals and groups.[2]

[2] KEYS was developed through a collaboration between Teresa Amabile and the Center for Creative Leadership. Researchers interested in using KEYS in their work should contact Teresa Amabile, Harvard Business School, Soldiers Field Road, Boston, MA 02163. Others interested

KEYS research falls into two primary categories. The first is basic psychometric research on the factor structure and reliability of the scales, as well as their test-retest reliability, their convergent validity, and their discriminant validity. This research consisted of analyses of data from several different samples of KEYS respondents, collected over a period of several years. KEYS results, as well as results from other questionnaires administered to some of these samples, allowed examination of (1) the degree to which the KEYS scale structure fits a confirmatory factor analysis; (2) the reliability or internal consistency of the scales—the degree to which each item on the questionnaire statistically fits with the other items on its particular scale; (3) short-term test-retest reliability, to determine that respondents' answers are not random; (4) convergent validity, to determine that KEYS does assess aspects of the work environment, by correlating it with another, established measure of work environment; and (4) discriminant validity, to determine that KEYS scores do not simply reflect the respondents' personalities or cognitive styles. Such discriminant validity also increases confidence that the instrument is assessing something in the environment, external to the individual respondents.

The second category of KEYS research consists of a single major construct-validity study that was conducted in three phases. In the first phase, a set of high-creativity projects and a set of low-creativity projects were nominated within a single large organization. Preliminary assessments of the work environments of these projects were obtained using KEYS. In the second phase, independent experts within the organization rated the nominated projects on creativity. In the third phase, additional KEYS data were collected on subsets of the high- and the low-creativity projects. This study was designed to test the hypotheses outlined in Figure 1.

> *Hypothesis 1: The work environment stimulant scales on KEYS will be rated significantly higher in projects rated as highly creative than in projects rated as less creative. Thus, ratings should be significantly higher in the high-creativity projects than in the low-creativity projects for the following scales: (1a) organizational encouragement, (1b) supervisory encouragement, (1c) work group supports, (1d) freedom, (1e) sufficient resources, and (1f) challenge.*
>
> *Hypothesis 2: The work environment obstacle scales on KEYS will be rated significantly lower in projects rated as highly creative than in projects rated as less creative. Thus, ratings should be significantly lower in the high-creativity projects than in the low-creativity projects for*

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in KEYS should contact Bill Howland (910-545-3754) or Alice Plybon (910-545-3756), both at the Center for Creative Leadership, PO Box 26300, Greensboro, NC, 27438-6300.

the following scales: (2a) workload pressure and (2b) organizational impediments.

This study was also designed to determine the relative strength of the various work environment dimensions in differentiating between these distinct project outcomes and to examine the degree to which different project team members agree in their independent assessments of their project work environment using KEYS.

The remainder of this article first describes the psychometric research and then the validity research; it ends with a general discussion of the implications for theory, research, and practice.

PSYCHOMETRIC CHARACTERISTICS OF KEYS

Methods: Samples

The current KEYS database consists of 12,525 cases. Of these, 9,729 were participants in a variety of public management programs at the Center for Creative Leadership and the participants' co-workers at their home organizations (usually, groups of 4–9 individuals from a given organization). The remaining 2,796 respondents came from a variety of functions and departments in 21 different organizations. These organizations represent a number of industries, including high technology, biotechnology, and electronics; chemicals, pharmaceuticals, and health products; traditional research and development; traditional manufacturing; banking; and consumer products. These data were collected over the years 1987–95.

Methods: Measures

Work environment perceptions (KEYS). The original item pool for KEYS was composed by reference to the interviews in the critical incident study (Amabile & Gryskiewicz, 1987), theory, and previous work by other researchers; an attempt was made to comprehensively tap perceptions of all work environment dimensions that might serve as creativity influences. KEYS is currently in its fourth revision. Revisions of the instrument have consisted of rewriting, adding, and deleting items (cf. Amabile & Gryskiewicz, 1989; Amabile, Gryskiewicz, Burnside, & Koester, 1990). These revisions were based on statistical analyses of items and scales (including analyses of the normality of response distributions on items and scales, factor analyses, and internal consistency analyses), and on semistructured focus groups and individual interviews with corporate employees and managers who volunteered to discuss the instrument's items.

Of the 78 items on the current version of KEYS, 66 describe the work environment. The remaining 12 items are included to gauge the respondents' assessments of two work performance criteria: the creativity (6 items) and productivity (6 items) of the work being carried out in their units. All items on KEYS are written as simple descriptive statements of the work environment or the work. In order to avoid response bias, some items were worded

positively and some were worded negatively. A four-point response scale is presented on KEYS; the intent was to avoid a midpoint in order to force respondents away from a neutral default option. The points on the scale correspond to a rating of "how often true" the statement is of a respondent's current work environment (never or almost never, sometimes, often, always or almost always). The instructions define "current work environment" as "the day-to-day social and physical environment in which you currently do most or all of your work."

The work environment scales on the current KEYS were derived by both conceptual grouping of the 66 environment items and examination of principal components factor analyses of those items. This process yielded eight environment scales, six assessing proposed stimulants to creativity (dimensions that should lead to higher creativity) and two assessing proposed obstacles (dimensions that should lead to lower creativity). The remaining 12 items form two criterion scales. Table 1 presents the scales' names, their descriptions, and sample items.

Convergent validity. The measure used to establish convergent validity was the Work Environment Scale (WES; Insel & Moos, 1975), a well-established general measure of work environments in organizations. Although this measure was not specifically designed to assess aspects of the work environment that are most relevant to creativity (as KEYS was), its scales should correlate moderately with KEYS if the latter instrument does indeed assess perceptions of the work environment.

Discriminant validity. Two measures were used to establish discriminant validity by demonstrating that KEYS responses do not simply reflect individual characteristics of respondents. Because KEYS is oriented toward creativity, a widely used measure of creative cognitive style was chosen. This instrument, the Kirton Adaption-Innovation Inventory (KAI; Kirton, 1976), assesses stable individual differences in the tendency to take radically different approaches to problems. In addition, because creativity is influenced by an individual's intrinsic or extrinsic motivation, a measure of motivational orientation was also chosen for the demonstration of discriminant validity. This instrument, the Work Preference Inventory (WPI; Amabile, Hill, Hennessey, & Tighe, 1994) assesses stable individual differences in intrinsic-extrinsic motivational orientation. If indeed KEYS responses reflect perceptions of creativity-relevant aspects of the external work environment rather than creativity-relevant characteristics of respondents, KEYS scale scores should be relatively uncorrelated with KAI and WPI scores.

Results and Discussion

KEYS scale structure and reliability. Maximum likelihood confirmatory factor analysis was used to evaluate the eight-factor model of the work environment scales. LISREL VII was used for the analysis (Jöreskog & Sörbom, 1986). The input matrix was a correlation matrix of the 66 work environment items from a database of 26 companies ($N = 3,708$). A simple struc-

TABLE 1
KEYS Scales

Scale Name	Number of Items	Description	Sample Item
Stimulant scales			
Organizational encouragement	15	An organizational culture that encourages creativity through the fair, constructive judgment of ideas, reward and recognition for creative work, mechanisms for developing new ideas, an active flow of ideas, and a shared vision of what the organization is trying to do.	People are encouraged to solve problems creatively in this organization.
Supervisory encouragement	11	A supervisor who serves as a good work model, sets goals appropriately, supports the work group, values individual contributions, and shows confidence in the work group.	My supervisor serves as a good work model.
Work group supports	8	A diversely skilled work group in which people communicate well, are open to new ideas, constructively challenge each other's work, trust and help each other, and feel committed to the work they are doing.	There is free and open communication within my work group.
Sufficient resources	6	Access to appropriate resources, including funds, materials, facilities, and information.	Generally, I can get the resources I need for my work.
Challenging work	5	A sense of having to work hard on challenging tasks and important projects.	I feel challenged by the work I am currently doing.
Freedom	4	Freedom in deciding what work to do or how to do it; a sense of control over one's work.	I have the freedom to decide how I am going to carry out my projects.
Obstacle scales			
Organizational impediments	12	An organizational culture that impedes creativity through internal political problems, harsh criticism of new ideas, destructive internal competition, an avoidance of risk, and an overemphasis on the status quo.	There are many political problems in this organization.
Workload pressure	5	Extreme time pressures, unrealistic expectations for productivity, and distractions from creative work.	I have too much work to do in too little time.
Criterion scales			
Creativity	6	A creative organization or unit, where a great deal of creativity is called for and where people believe they actually produce creative work.	My area of this organization is innovative.
Productivity	6	An efficient, effective, and productive organization or unit.	My area of this organization is effective.

ture was maintained; each item was permitted to load only onto one latent variable (scale). One item per concept was fixed at one to establish a scale for each latent variable. The factor variance-covariance matrix (phi matrix) was set as a free symmetric matrix. The variance-covariance matrix of measurement errors (theta delta) was a diagonal free matrix.

The overall fit measures show a moderate fit to the data (goodness-of-fit index = .85; adjusted goodness-of-fit index = .84; chi-square (2,051) = 17,305.48, $p < .001$; root mean square residual = .056), with the large chi-square value indicating room for improvement. The component fit measures show that all items loaded significantly onto their scales (p's < .001). The modification indices are quite high for many items, indicating that these items load onto more than one factor. Given the nature of the instrument, this is not surprising; the concepts measured by KEYS are theoretically related. Thus, although a more complex model (one in which items are permitted to load on several factors) would better fit the data, maintaining a simple structure was central to the purpose of separately assessing each aspect of the work environment that is thought to be related to creativity.

Table 2 presents additional psychometric data on KEYS. As can be seen, internal scale reliabilities (Cronbach's alpha) vary from minimally acceptable (.66) to extremely strong (.91), with a median that is quite good (.84). Indeed, only two of the scales (freedom and workload pressure) show reliabilities lower than .80. The environment scales generally intercorrelate at moderate levels, indicating elements of both commonality and distinctiveness in the different work environment dimensions. The test-retest reliabilities of the scales, across a period of three months, are good. Note that short-term test-retest reliability of an environment inventory is desirable, to indicate that responses are not merely capricious or influenced by highly transitory but irrelevant forces. However, we would not necessarily expect scores on an environment inventory to stay stable across long periods of time. As an environment changes, which most environments do, ratings on an environment inventory should also change.

Convergent and discriminant validity. The preliminary evidence on convergent and discriminant validity is encouraging. As seen in Table 2, the KEYS scales do correlate moderately with the scales on another work environment inventory, the WES. Moreover, KEYS shows relatively low correlations with a personality measure of motivational orientation, the WPI, and with a measure of cognitive style, the KAI. This pattern of correlations suggests that respondents' ratings of their work environments are not merely reflections of their own personal characteristics.

A first step toward asserting construct validity in a work environment instrument is to demonstrate that it discriminates between different work environments. As a start, it should yield different results for different organizations. A multivariate analysis of variance (MANOVA) on all KEYS scales, with company as the independent variable, indicated highly significant differences between the work environments of different companies (multivariate $F_{250,\ 38,410} = 10.59$, $p < .001$). In addition, step-down univariate analyses

TABLE 2
KEYS Summary Table[a]

KEYS Scales	Reliability		Scale Intercorrelations: Median *r* with KEYS Stimulant & Obstacle Scales	Convergent Validity: Median *r* with WES Scales	Discriminant Validity:	
	Alpha	Test-Retest			Median *r* with WPI Scales	KAI *r*
Creativity stimulants						
Organizational encouragement	.91	.94	.49	.58	.02	−.11
Supervisory encouragement	.91	.90	.42	.43	.03	−.27
Work group supports	.86	.88	.42	.32	.00	−.16
Sufficient resources	.83	.75	.34	.45	.00	−.10
Challenging work	.79	.82	.36	.42	.03	−.14
Freedom	.66	.80	.36	.23	−.08	−.02
Creativity obstacles						
Organizational impediments	.84	.89	.41	−.53	−.03	.14
Workload pressure	.77	.71	.24	−.06	−.02	−.03
Criterion scales						
Creativity	.84	.87	.46	.43	.09	−.02
Productivity	.86	.84	.47	.46	.06	−.14
N	>12,100	40	>12,100	56	69	69

[a] All correlations are statistically significant ($p < .05$), except those in the last two columns (discriminant validity). WES is the Work Environment Scale (Insel & Moos, 1975); WPI is the Work Preference Inventory (Amabile et al., 1994); KAI is the Kirton Adaption-Innovation Inventory (Kirton, 1976). Median correlations are presented for those instruments having several scales.

of variance revealed highly significant overall across-company differences on each of the eight environment scales and on both criterion scales (all p's $< .001$).

Thus, in general, the psychometric characteristics of KEYS are satisfactory. Further psychometric development of the instrument should be directed toward improvement of the reliability of the freedom scale, perhaps by the addition of items, and the collection of additional convergent and discriminant validity data.

A TEST OF THE VALIDITY OF KEYS

Although results on differences in KEYS scales across companies begin to establish the construct validity of KEYS, stronger evidence is needed. To this end, a study was conducted to test the ability of KEYS to discriminate between work environments where demonstrably creative work is being produced and work environments where notably less creative work is being produced. This study was designed to determine whether the stimulant scales would be rated higher (Hypotheses 1a–1f), and the obstacle scales lower (Hypotheses 2a and 2b), for work environments surrounding projects with highly creative outcomes, compared to environments of projects with less creative outcomes. A strong test of these hypotheses required that the highly creative and less creative projects be rated as such not only by members of the project teams but also by experts external to the project teams.

In addition, this study was designed to explore the possibility that certain aspects of the work environment might more strongly and consistently discriminate between high- and low-creativity projects than others. As noted earlier, in the literature on environmental influences on organizational creativity, certain dimensions appear more prominently: organizational encouragement of (or orientation toward) innovation, freedom (autonomy), and resource availability. However, there is no clear evidence on the importance of these factors, relative to the importance of others that have been mentioned, such as time pressure and the challenge level of the work.

Methods

The study was conducted at a company we call High-Tech Electronics International, a United States company of over 30,000 employees providing diversified electronics products to international markets. In phase 1 of the study, both technical and nontechnical middle-level managers were individually asked to nominate both the highest-creativity and the lowest-creativity project with which they had been involved during the previous three years in the company. For both projects, they were asked to select only from that set of projects in which *creativity was both possible and desirable;* creativity was defined as "the production of novel *and* useful ideas by individuals or teams of individuals." These managers were selected across four major divisions of the company. They briefly described each nominated project (using a standard questionnaire) and completed a KEYS on each

project. They also provided some background information on themselves. The KEYS ratings in phase 1 were used to provide preliminary tests of Hypotheses 1 and 2 and to allow preliminary exploration of the relative importance of the different work environment dimensions.

It is important to note that, although the instructions for the standard KEYS survey instruct respondents to answer the questions by reference to their "current work environment," the instructions were customized for this validity study. Because the outcome measure to be obtained was a measure of the creativity of the work on a specific team project, respondents were told to answer the KEYS questions by reference to the work environment surrounding that particular project.

Phase 2 of the study was conducted to validate the creativity nominations of phase 1, by allowing independent expert assessments of the level of creativity in the projects nominated in phase 1. A group of experts from each of the divisions sampled in phase 1 was asked to independently rate the projects nominated from that division on creativity, quality, and their degree of familiarity with the project. These experts were kept blind to the initial nomination status of the projects, and high- and low-creativity projects were randomly intermixed in the experts' rating questionnaires. (They were asked to skip the ratings for any projects with which they were not familiar.)

Phase 3 was conducted to validate the environment assessments and creativity differences of phase 1, with a different sample, composed of individuals who were unaware of the study's purpose. In essence, it was a conceptual replication of phase 1; it was used to allow more conservative tests of Hypotheses 1 and 2 and further exploration of the relative strengths of the dimensions. We selected a subsample of projects for phase 3, because our resources did not permit us to include all projects from phase 1 in phase 3. Each team member of a project in this subsample was asked to complete a KEYS survey to describe the work environment of his or her particular project. These respondents did not know that the study concerned creativity, or that their projects had been chosen for any particular reason. Indeed, potential phase 3 respondents were eliminated if they had participated in phase 1. Each respondent in phase 3 described the environment for only one project.

Results

Phase 1: Preliminary tests of Hypotheses 1 and 2. Of those who received the initial mailings, 42 percent responded, yielding usable data on 306 projects, for a response rate of 42 percent. Discussions with high-level informants within the organization confirmed that these were primarily early-development-stage projects, often many years away from implementation. The vast majority (93%) of respondents were directly involved in the nominated projects, either as team members (58%) or as project leaders (35%) who were in many cases also team members. Most respondents were closely familiar with the projects; 62 percent reported daily involvement, and 32

percent reported weekly involvement. Moreover, most projects were remembered clearly by their nominators; fully 98 percent of the projects were rated as at least "moderately clear" in memory by their nominators.

Overall, the correlation between rated creativity and rated quality of the projects (as rated by the nominators) was substantial ($r = .57$, $p < .001$). Given our instructions to respondents, defining creativity in terms of novel *and* useful ideas, and stating that nominated projects should be those in which creativity was both possible *and desirable,* it is not surprising that low-creativity projects tended to be rated low in overall quality. However, this does not mean that project creativity and project quality were seen as merely the same thing. Although the relationship between creativity and quality accounts for 32 percent of the variance in creativity ratings, factors beyond project quality account for 68 percent of the variance in creativity.

As expected, the nominated high- and low-creativity projects were significantly different in creativity and quality, as rated by the persons who nominated the projects. On a five-point scale, the mean creativity ratings were 4.24 (s.d. = .88) for high-creativity projects and 2.58 (s.d. = 1.07) for low-creativity projects ($t_{143} = 14.86$, $p < .001$). The mean quality ratings were 4.19 (s.d. = .86) for the high-creativity projects and 3.19 (s.d. = 1.04) for the low-creativity projects ($t_{138} = 8.94$, $p < .001$).

Hypotheses 1 and 2 predict that the high- and the low-creativity projects would have substantially different perceived work environments. A multivariate analysis of variance, combining across all KEYS scales, revealed a significant difference between high- and low-creativity projects ($F_{10,\ 131} = 17.19$, $p < .001$). Moreover, as Table 3 shows, all of the KEYS scales showed significant differences in the step-down univariate analyses, in the predicted directions.

Table 3 also includes effect sizes (partial eta-squared).[3] Clearly, although high- and low-creativity projects are statistically different on all of the work environment scales, six aspects of the work environment discriminate most strongly: challenging work, organizational encouragement, work group supports, freedom, organizational impediments, and supervisory encouragement. Comparatively, sufficient resources, and especially workload pressures, show less distinction between the high- and low-creativity projects. Interestingly, earlier research using quite different methodologies (Amabile & Gryskiewicz, 1989) obtained conceptually similar results.

Several additional analyses were carried out to assess the possibility that the work environment differences observed between high- and low-creativity projects could be attributed to other project variables. There were no significant differences between high- and low-creativity projects in terms of type of project nominated (technical vs. nontechnical), project length, size of project team, organization of project team, location of project team, or

[3] Partial eta-squared is a measure of effect size that can be interpreted as the percentage of variance accounted for; it is applicable to all F and t tests (Stevens, 1992).

TABLE 3
Phase 1 Work Environment Assessments for 141 Pairs of High- and Low-Creativity Projects[a]

KEYS Scales	Hypothesis Tested	High Creativity Mean	High Creativity s.d.	Low Creativity Mean	Low Creativity s.d.	$F(1,140)$	Partial Eta-Squared
Work environment scales							
Challenging work	1f	3.30	.52	2.66	.63	110.47***	.44
Organizational encouragement	1a	2.99	.58	2.38	.60	110.21***	.44
Work group supports	1c	3.34	.52	2.75	.62	96.12***	.41
Freedom	1d	3.10	.51	2.51	.66	90.37***	.40
Organizational impediments	2b	1.91	.54	2.46	.62	80.44***	.36
Supervisory encouragement	1b	3.10	.59	2.63	.69	60.27***	.30
Sufficient resources	1e	2.96	.57	2.65	.61	35.07***	.20
Workload pressure	2a	2.40	.56	2.55	.65	6.95**	.05
Criterion scales							
Creativity		3.09	.56	2.32	.62	165.68***	.54
Productivity		3.22	.56	2.58	.65	83.33***	.37

[a] Means are on a four-point scale, with a higher number indicating a higher level of the variable.

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

nominator's role on the project (technical vs. nontechnical). Only two differences emerged on control variables. Respondents tended to report lower frequency of contact with their low-creativity projects ($t_{144} = 5.08$, $p < .001$), and they tended to report recalling the high-creativity projects better ($t_{138} = 4.60$, $p < .001$). Because these differences may have affected perceptions of the work environment, the MANOVA on the KEYS scales was repeated twice, once covarying contact frequency and once covarying clarity of recall. Neither factor was a significant covariate, and the work environment differences between high- and low-creativity projects were still obtained.

Thus, phase 1 provided strong support for Hypotheses 1 and 2.

Phase 2: Validation with independent assessments of creativity. The primary purpose of phase 2 was to validate the creativity nominations from phase 1; it is important to show that the obtained work environment differences apply to projects that are truly different in creativity. For this reason, we included in our phase 2 analysis only projects that had been rated by three or more experts. This procedure yielded a total of 94 rated projects from the three divisions that could be sampled in this phase.

Like the phase 1 respondents who nominated these projects, the expert raters from phase 2 viewed the projects' quality and creativity as highly related ($r = .68$, $p < .001$). Because different raters rated different subsets of projects, we assessed the reliability of the expert creativity assessments us-

ing intraclass correlation (ICC).[4] This statistic indicated a modest degree of consistency between raters ($ICC_{1,k} = .58$). Despite the relatively low reliability of these creativity ratings, projects that had been nominated in phase 1 as high-creativity were still found to be significantly higher in expert-rated creativity than those that had been nominated as low-creativity projects ($t_{92} = 3.42$, $p < .001$). This finding supports the creativity nominations of phase 1.

Phase 3: Additional tests of Hypotheses 1 and 2. Only projects that had been assessed by at least three phase 2 raters were included in phase 3. We also required that the raters' familiarity ratings average at least 3.0 (midpoint on the scale). Then, to ensure selection of only truly high- and low-creativity projects, we eliminated those with an average expert-rated creativity score within 1 standard deviation of the mean (1/2 standard deviation on each side). Finally, we removed a few projects with mean phase 2 ratings falling into the high-creativity category if they were originally nominated as low-creativity in phase 1, and vice versa.

This procedure yielded 36 projects (18 high-creativity and 18 low-creativity). The level of agreement between the phase 2 expert creativity ratings on these 36 projects was quite acceptable ($ICC_{1,k} = .76$). Of the 36 project leaders, 24 provided names of all project team members who were still with the company. All of those project members (except two who had previously participated in phase 1) were then asked to complete a KEYS to describe the work environment surrounding that project. Because one of these projects was rated by only one phase 3 respondent, the final number of phase 3 projects was 23 (12 high-creativity and 11 low-creativity).

Of the 250 project team members who received phase 3 packets, 170 (68%) returned usable questionnaires. Of these, 95 percent reported that they could recall the project environment at least moderately clearly. In addition, the majority of respondents (78%) reported daily involvement with the rated project.

Interrater reliabilities were computed on KEYS for each project assessed in phase 3, using data from both the original project nominator (from phase 1) and the raters in phase 3. Cronbach's alpha was used to assess the reliability of the mean work environment ratings for each project. Overall, the reliabilities of the environment perceptions were acceptable (median = .75), with alphas ranging from .21 to .93, and with generally higher reliabilities for the high-creativity projects. It is possible that these very advantageous work environments are more salient and consistent, and thus they are more uniformly perceived by those who work in them. Over both high- and low-creativity projects, however, the alphas are sufficient to allow acceptance of

[4] When each target is rated by a different set of k judges and their ratings will be averaged, as in phase 2, a one-way analysis of variance (ANOVA) is used to estimate the variance of interest and error; the appropriate formula is $ICC_{1,k} = (BMS - WMS)/BMS$ (Bartko, 1966; Shrout & Fliess, 1979; BMS = between-mean-square, WMS = within-mean-square).

the mean of the ratings from a given project team's members as a fairly reliable estimate of the work environment of the project.[5]

Our central prediction was that the perceived project environments of the high- and the low-creativity projects would differ, in the same directions found in phase 1. Table 4 presents the results of this analysis, which support our hypotheses for most of the KEYS scales.[6] The high-creativity project environments were higher on the creativity stimulant scales of work group supports, challenging work, organizational encouragement, and supervisory encouragement. Additionally, the freedom scale was marginally higher for high-creativity projects. Low-creativity projects, in contrast, were rated as higher on the creativity obstacle scale of organizational impediments. No differences were found for the workload pressure and sufficient resources scales. Also as expected, both criterion scales (creativity and productivity) were significantly higher for the high-creativity project environments. As was found in phase 1, these two criterion scales were highly correlated (r = .61, $p < .001$).

Because recall clarity and frequency of contact with the project were related to creativity level in the phase 1 data, we repeated this analysis covarying for these factors. Neither variable was a significant covariate, and the work environment differences originally observed were still obtained.

Phase 3 was intended as a conceptual replication of phase 1, with multiple independent raters who were unaware that the study concerned creativity and rated only one project, rather than contrasting two projects. Thus, it is essential to examine the correspondence between phase 1 and phase 3 data. Figure 2 shows that, in nearly all respects, the phase 3 results mirror those of phase 1. The primary difference is that the phase 3 results are less powerful; overall, the separation between the high- and low-creativity projects is smaller.

Thus, phase 3 partially supports Hypotheses 1 and 2. Specifically, it supports Hypotheses 1a (organizational encouragement, 1b (supervisory encouragement), 1c (work group supports), 1f (challenge), and 2b (organizational impediments). It does not support Hypotheses 1e (sufficient resources), 2a (workload pressure), and 1d (freedom).

Discussion

Overall, this study provides important construct validity information on KEYS and supports the conceptual model presented in Figure 1. High-creativity projects were generally rated higher on the KEYS scales proposed

[5] When the phase 3 analyses are repeated with only those 15 projects having interrater reliabilities above .70 (6 low-creativity and 9 high-creativity), the results are completely consistent with those reported in Table 3 and are, in fact, somewhat stronger.

[6] Although the overall multivariate F was not statistically significant, we proceeded with the individual planned comparison tests for each KEYS scale. According to both Hays (1981) and Stevens (1992), previously planned comparisons with an empirical or theoretical basis should be carried out, even when the effect of an overall ANOVA is not significant.

TABLE 4
Phase 3 Work Environment Assessments for 12 High-Creativity and 11 Low-Creativity Projects[a]

KEYS Scales	Hypothesis Tested	High Creativity Mean	High Creativity s.d.	Low Creativity Mean	Low Creativity s.d.	$F(1,140)$	Partial Eta-Squared
Work environment scales							
Work group supports	1c	3.30	.31	2.94	.26	9.12**	.30
Challenging work	1f	3.25	.22	2.87	.43	7.05*	.25
Organizational encouragement	1a	2.83	.33	2.51	.26	6.55*	.24
Supervisory encouragement	1b	3.12	.42	2.78	.34	4.54*	.18
Organizational impediments	2b	2.05	.37	2.32	.28	3.83†	.15
Freedom	1d	2.94	.30	2.72	.38	2.38‡	.10
Workload pressure	2a	2.52	.19	2.62	.40	.71	.03
Sufficient resources	1e	2.83	.33	2.78	.33	.10	.00
Criterion scales							
Creativity		2.89	.28	2.60	.27	6.43*	.23
Productivity		3.02	.33	2.72	.32	4.94*	.19

[a] Means are on a four-point scale, with a higher number indicating a higher level of the variable.

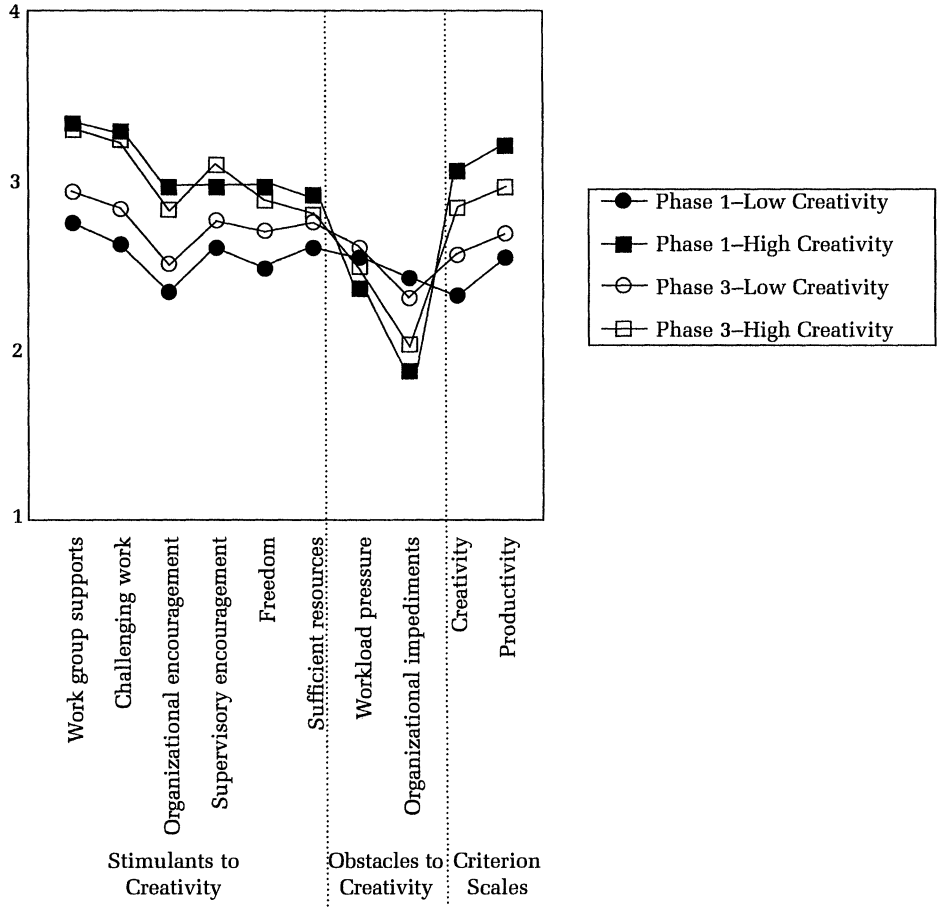
* $p < .05$
** $p < .01$
† $p = .06$
‡ $p = .15$

as stimulants to creativity and lower on the KEYS scales proposed as obstacles to creativity. These findings were bolstered by independent creativity assessments by internal company experts and by independent work environment assessments by various project team members.

This validity study is useful in a number of ways. It is the first study to obtain independent quantitative measures of the work environment from several respondents in each work environment and separate independent quantitative measures of the creativity of the work being done in those environments. Moreover, the findings of the study are applicable to both technical and nontechnical work; no clear differences were found between the two categories of projects. Additionally, the study demonstrates that work environment perceptions can be aggregated across different respondents within the same environment.

However, some cautions apply to the interpretation of the results of this validity study. Because the outcome measure was work produced by a project team, and because the work environment perception measures were aggregated at the level of the team, the results are only directly generalizable at that level. Although it is reasonable to assume that KEYS measures aggregated at other levels, such as departments, should be similarly related to

FIGURE 2
Work Environments of High- and Low-Creativity Projects



creativity measures at those levels, such applicability will require further research for confirmation.

Importantly, causal interpretations cannot be drawn from this observational study. It is true that many of the findings in this study match well with the results of research reviewed earlier and with the results of experimental studies in which environment has been manipulated (e.g., Amabile, 1983). Nonetheless, it may well be the case that at least some of the work environment factors studied here are *consequences* of the level of project creativity, rather than causes. Indeed, it is likely that a complex causality accounts for variations in project creativity and project work environment, whereby the nature of the work and the nature of the work environment are both causes and consequences in a complex chain of feedback loops.

Caution is also warranted in view of the modest response rates in the

validation study. It is possible that the respondents were the most innovative or committed members of the organization. If this were the case, however, the consequence might be constrained variance, leading to a conservative test of our hypotheses. It is also possible that these individuals have different perceptions of creative work environments and creative projects; however, it may well be the perceptions of the most innovative organizational members with which researchers should be most concerned.

Additionally, a number of biases might have been operating in this study. *Memory biases* could have entered in, particularly for the phase 3 respondents. Nearly half of all projects nominated in phase 1 were currently ongoing (and virtually all had been conducted in the previous three years), but an additional nine months passed before the phase 3 respondents made their ratings. Thus, it is possible that clouded recollections somewhat compromised accuracy of reporting. This may partially account for the relatively weaker effects in phase 3. Of course, it is also possible that the work environments of ongoing projects actually changed in the nine months.

Several other potential biases were at least partially addressed in the research design. Although *idiosyncrasy biases* might have entered into phase 1, in which a single individual identified and described projects that he or she personally saw as high or low in creativity, such biases were counteracted by the independent creativity assessments of phase 2 and the independent work environment assessments of phase 3. In addition, *respondent biases* might have been operating in phase 1. Because phase 1 respondents were asked to recall their highest-creativity and their lowest-creativity projects, they likely made implicit comparisons between these projects as they completed the two KEYS surveys. As a result, their responses may have been tainted by their preconceived notions of what contributes to a high- or low-creativity environment. However, this bias is much less likely to have occurred in phase 3, where respondents filled out a KEYS for only one project, without knowing that the study concerned creativity. Similarly, we attempted to overcome *common method bias* by using an entirely different data collection tool in phase 2, as well as different instructions for KEYS in phases 1 and 3.

However, one bias is potentially more problematic. A *halo effect* might have been operating, leading individual respondents in the study to rate "good" projects favorably and "poor" projects unfavorably on all dimensions, without discriminating among different aspects of project environments or project outcomes. If this were the case, then we would not be able to say confidently that the KEYS scales assess specific aspects of the work environment for creativity and only for creativity. Indeed, there were substantial intercorrelations between some of the KEYS scales (as is always the case with KEYS), and ratings of the creativity and the quality of the nominated projects correlated strongly. For several reasons, however, it is unlikely that simple halo effects account for all the obtained results. First, there were considerable differences between scales in the effect sizes of differences between high- and low-creativity projects. Thus, it appears that re-

spondents were not simply responding uniformly to all of the items. Second, different individuals participated in each of the three phases. Halo effects have been documented in the social psychology literature for individuals; it is less likely that a mass halo effect was operating, leading the different project members in phases 1 and 3 and the independent experts in phase 2 to all respond in the same biased way. Third, given that these were early-development projects, the ultimate success of most projects was not known at the time of any of the data collections.

Clearly, it is still possible that some general halo effects were operating. Given the design of the study, we cannot definitively state that the KEYS scales assess the work environment only for creativity. However, it would be unreasonable to expect that work environment factors relevant for creativity would be completely irrelevant for other aspects of work. We suggest only that the instrument will be useful if its scales tap aspects of the environment that are particularly relevant for creativity—even though they may be relevant for other work outcomes, as well.

CONCLUSIONS

KEYS can be useful in future research and theory development in organizational creativity by providing scholars with a psychometrically sound tool for quantitatively assessing the perceived work environment for creativity. This tool can be profitably used in conjunction with interviews and other questionnaires, as has been done in recent research (e.g., Amabile & Conti, 1994). Whether used alone or with other methods, this instrument and the model upon which it is based give researchers a way to seriously turn their attention toward creativity in organizations, which is the root of innovation. Rather than focusing on the personality characteristics that dominated earlier psychological research on creativity, or the organizational structures for implementation that have dominated organizational studies of innovation, the present approach highlights the psychological context of innovation—the work environment perceptions that can influence the level of creative behavior displayed in the generation and early development of new products and processes. Creative ideas from individuals and teams within organizations sow the seeds of successful innovation; scholars of innovation must seriously consider characteristics of the organizational context that can impede or support the generation of those ideas.

The research reported here suggests several directions for future research. One of the most important results of the validation study concerns the differential strength of different work environment dimensions. The study allows for a reasonably confident assertion that perceptions of five work environment dimensions do consistently differ between high- and low-creativity projects, and thus these dimensions may play an important role in influencing creative behavior in organizations: challenge, organizational encouragement, work group supports, supervisory encouragement, and organizational impediments. Notably, three of these five dimensions have not

appeared prominently in previous research or theory: challenge, work group supports, and organizational impediments. The relative lack of attention to these dimensions is particularly surprising, because challenge and work group supports showed the highest effect sizes in both phase 1 and phase 3. Perhaps just as surprising, the study suggests that three other dimensions may play a less prominent role in organizational creativity: resources, workload pressures, and freedom. Two of these, freedom (autonomy) and resources, have been mentioned frequently in the literature. Although the freedom results were strong in phase 1 and weak in phase 3, the resources and workload pressures results were weak in both phases 1 and 3. Finally, our results confirmed the prominence given to two dimensions in previous work: organizational encouragement and supervisory encouragement. Future research should be directed toward replicating and elaborating the differential impact of different work environment dimensions.

Additional construct validity studies are needed, such as (1) studies in which different individuals, such as outside observers, are responsible for initial identification of high- and low-creativity projects, (2) studies of projects in which creativity and quality might be more clearly separable, (3) studies in different types of organizations, and with a wider variety of project types, and (4) predictive validity studies, in which the work environment assessed at one point in time can be used to predict the creativity of work outcomes at some later point in time. Such studies should use a variety of methods, in combination with KEYS, to focus specifically on both the unexpectedly weaker dimensions in the current study (freedom, resources, and workload pressure), and the unexpectedly stronger dimensions (challenge, work group supports, and organizational impediments).

The study at High-Tech Electronics validated KEYS at the level of team project creativity and perceived project team work environment. Like many researchers (e.g., Ancona & Caldwell, 1992), we consider studies at this level particularly useful both theoretically and practically. However, KEYS should be applicable beyond this level. Because KEYS assesses psychological perceptions of the work environment, regardless of the level within an organization at which influences on those perceptions arise, the instrument should be applicable at the level of departments, divisions, or even small organizations—as long as the individual respondents perceive themselves to be working within the same environment. Such research would require aggregating responses at those levels and, importantly, it would require meaningful, reliable measures of the creativity of the work being produced at those levels. Although greater variabilities in work environments assessed at broader levels would increase the error variance in these studies, it should still be possible to find differences in the same direction as those discovered at the project level.

Ultimately, research should be directed toward discovering the precise connections between particular events in individuals' work experience and their resulting perceptions of the work environment. From the present results, it appears that people will produce more creative work when they

perceive, for example, that management is encouraging them to solve problems creatively. The challenge for future research will be to determine the specific managerial behaviors and other events within (and outside of) their organizations that lead people to perceive such encouragement. Such findings would be important not only for theory development but also for application to managerial practice.

KEYS has potentially broad applicability in organizations. It can be used not only to diagnose the relative degree to which an organization's work environment fosters creative work, but also to assess the effectiveness of environmental improvement efforts. As a part of its diagnostic function, it can specify particular areas of a work environment that are relatively strong or weak at a given point in time, helping managers and organizational leaders to identify directions for action. For example, if a given department scores particularly low on the challenge dimension, that department's manager might pay greater attention to appropriately matching employees to projects so that, whatever their skill level, they feel challenged by and interested in assigned projects.

Perhaps the most important lesson for management from the results of our KEYS research is that the perceived work environment does make a difference in the level of creativity in organizations. Managers at all levels who wish to foster creativity and innovation within their organizations can do so not only by paying attention to what sort of individuals they hire—to the kind of personal characteristics and skills that early creativity research emphasized—but also by paying attention to the environments they create for these potentially creative individuals.

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Teresa M. Amabile is a professor of business administration at Harvard University. Formerly a professor of psychology at Brandeis University, she has studied the influence of the social environment on motivation, creativity, and innovation. Her current interests focus on the impact of daily events on work environment perceptions, motivation, and the creativity of the work done in project teams.

Regina Conti is an assistant professor of psychology at Colgate University. She completed her Ph.D. degree in social/developmental psychology at Brandeis University. Her recent research explores the antecedents of procrastination and the impact of downsizing on an organization's climate for innovation.

Heather Coon is a Ph.D. student in the social psychology program at the University of Michigan. She worked as a research assistant for Teresa Amabile for several years studying creativity and motivation. Her current research focuses on cultural norms and American individualism.

Jeffrey Lazenby is pursuing a Ph.D. degree in social psychology at the University of Southern California. His current research interests include customer satisfaction, multirater feedback, and organizational change.

Michael Herron is a consultant for Personnel Decisions International in Dallas, Texas. He earned a Ph.D. degree in organizational psychology from the California School of Professional Psychology. His work focuses primarily on individual assessment, leadership coaching, and organization development.

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