Knowledge Exploration and Exploitation: The Impacts of Psychological Climate and Knowledge Management System Access

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Firms need to balance efficiency gains obtained through exploiting existing knowledge assets with long-term competitive viability achieved through exploring new knowledge resources. Because the use of knowledge management systems (KMSs) continues to expand, understanding how these systems affect exploration and exploitation practices at the individual level is important to advance both knowledge management theory and practice. This study reports the results of a multi-industry survey investigating how psychological climate and KMS access influence solution reuse (exploitation) and solution innovation (exploration) in the context of technical support work. Our results show that KMS access does not directly determine solution innovation or solution reuse. Instead, KMS access strengthens the positive relationship between a climate for innovation and solution innovation and reverses the positive relationship between a climate for autonomy and solution innovation. The implications for knowledge management research and practice are discussed.

Key words: knowledge management systems; exploration; exploitation; psychological climate; technical support

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Introduction

Competitive pressures require firms to both explore new knowledge and exploit knowledge that they already have (Kane and Alavi 2007, March 1991). Exploration can lead to novel products, new procedures, and innovative solutions to problems. Exploitation leverages existing knowledge through the application of pre-established procedures, technologies, and solutions. Both exploration and exploitation are important sources of knowledge for a firm; however, because each requires purposeful effort and dedication of limited resources, simultaneously supporting and managing both these activities is a challenge for many organizations (Gupta et al. 2006).

Prior research shows that exploration and exploitation significantly affect organizational performance (e.g., Benner and Tushman 2003, Kane and Alavi 2007), yet underlying this work is the premise that individuals develop their own idiosyncratically acquired beliefs about reality (i.e., explore) or adopt and apply knowledge that is embedded within the organization (i.e., exploit) (Das 2003, Mom et al. 2007). In his foundational model, March (1991, p. 72) noted that exploration/exploitation behaviors take place within a nested system where parallel activities occur at both individual and organizational levels (Gupta et al. 2006, Mom et al. 2007). Recent computational modeling work extending March’s original model (Bray and Prietula 2007, Kane and Alavi 2007) demonstrates that organizational learning outcomes are affected by individuals’ propensity to rely on their own knowledge or use information technology to adopt organizational knowledge. However, this work does not address how individuals choose between exploiting and exploring in the first place, or how contextual factors such as psychological climate and access to knowledge management systems (KMSs) affect this decision. Scholars have thus called...
for empirical studies to better understand how individual exploration/exploitation behaviors are both shaped by environmental context and facilitated by information technology (Kane and Alavi 2007).

This paper addresses the following research question: How do psychological climate and KMS access interact with one another to shape individual exploration/exploitation behaviors? In the context of technical support, we develop a model of how psychological climate and access to KMSs interact to affect individuals’ tendency to explore based on their own resources and/or exploit existing organizational knowledge. We then test the model with data from seven technical support companies using hierarchical linear regression. We conclude by discussing implications for knowledge management research and practice.

Theoretical Background and Hypotheses

KMS and Technical Support

KMSs are information technology-based systems coupled with knowledge-sharing practices that support knowledge management efforts within an organization (Alavi and Leidner 2001). One domain in which KMSs play an increasing role is the work of helpdesk analysts (hereafter referred to as analysts) who provide technical support for software and hardware. Technical support KMSs increase analysts’ effectiveness by enhancing solution retrieval and providing greater consistency in answering customers’ phone calls (Davenport and Klahr 1998).

Technical support is an important context for exploration and exploitation. An analyst’s goal is to resolve customer problems with complex, technical products in a timely manner (Pentland 1992). As a firm develops KMS-based repositories of solutions, analysts may be able to exploit these solutions to solve problems (solution reuse). However, an analyst’s environment changes rapidly because of new problems with current products, new product introductions, and other updates (El Sawy and Bowles 1997). In such an environment, analysts must also explore their own solutions to problems (solution innovation). Both the exploitation of previous solutions and the exploration of innovative solutions are important problem-solving strategies in technical support work (Davenport and Klahr 1998).

Climate

Climate is a manifestation of organizational culture that can be measured through perceptions of observable practices and procedures (James et al. 2008). It is conceptualized as either organizational or psychological (D’Amato and Burke 2008). Although organizational climate represents a shared perception of organizational practices and characteristics of the work setting (Carless 2004), psychological climate emphasizes individual perceptions and interpretations of the organizational environment and is conceptualized as an individual-level variable (Koys and DeCotiis 1991, Parker et al. 2003). According to Carless (2004, pp. 407–408), “Psychological climate is important because it is the individual employees’ perceptions and evaluations of the work environment, rather than the actual environment, that mediates attitudinal and behavioral response.” Given our emphasis on individual-level behaviors in this study, we focus on psychological climate (hereafter referred to as climate).

Although climate has many facets (Koys and DeCotiis 1991), organizational researchers have advocated focusing on the specific climate variables that are expected to play a role in the context in question (Schneider 2000). Following this recommendation, we focus on two complementary climate dimensions that are integral to contemporary knowledge work: climate for innovation and climate for autonomy. Prior research has identified these climate dimensions as highly salient both to information technology workers (Igbaria and Siegel 1992) and to technical support personnel (McKnight et al. 2009). These factors have also been recognized as critical for knowledge workers in general (Cheney 1984, Goldstein and Rockart 1984) and have been shown to contribute to knowledge management–related outcomes (e.g., Gold et al. 2001, Janz and Prasarnphanich 2003).

Climate for Innovation. A climate for innovation exists when employees have the perception that change and creativity are encouraged in the workplace (Koys and DeCotiis 1991). An innovative climate encourages employees to creatively solve new and evolving problems (Amabile et al. 1996). Employees who are encouraged by their firm to engage in innovative behaviors will be more likely to experiment and take risks, approach problems in new ways, and generally be more innovative (Koys and DeCotiis 1991). Thus, we expect analysts to be more likely to engage in solution innovation in a climate they perceive as highly supportive of innovative behavior.

HYPOTHESIS 1 (H1). Climate for innovation is positively related to solution innovation.

We also expect that a climate for innovation will enhance solution reuse. A climate that supports innovative behavior enhances the degree to which workers seek help from their colleagues to solve problems

1 It is often assumed that exploration and exploitation are competing activities, but a growing body of work (Gupta et al. 2006) suggests that they can be achieved simultaneously. This implies that a single variable like climate for innovation may simultaneously enhance both solution innovation and solution reuse.
(Burke and Weir 1978). More generally, an innovative climate has been found to promote greater interaction among knowledge workers and an increased disposition toward knowledge exchange as a problem-solving strategy (Edmonson 1999, Hoegl et al. 2003). Workers who perceive a strong climate for innovation should thus be more inclined to seek and reuse the knowledge of others than those whose climate makes them feel content with their own body of knowledge or vulnerable to reprisals for not knowing the answers (Chen and Huang 2007). Accordingly, we anticipate that analysts will be more inclined to reuse solutions in a climate they perceive to be supportive of innovative behavior.

**Hypothesis 2 (H2). Climate for innovation is positively related to solution reuse.**

**Climate for Autonomy.** A climate for autonomy exists when employees have self-determination with respect to work procedures, goals, and priorities (Joyce and Slocum 1984, Koys and DeCotiis 1991). A climate that supports individual autonomy increases independence and reduces reliance on others as a guide to behavior (Alavi et al. 2005, Janz and Prasarnphanich 2003). Existing theory offers little insight into whether an autonomous analyst will engage in greater solution reuse; an analyst who has a high degree of latitude in managing her own behaviors may or may not choose to reuse an existing solution to solve a technical support problem. Thus, we do not expect a climate perceived as supporting autonomy to have a significant effect on solution reuse. However, research does suggest that autonomous employees are more apt to meet job requirements in innovative ways (Amabile et al. 1996), because they have more “need and freedom to apply [innovative solutions] than employees who receive very detailed instructions” (Cabrera et al. 2006, p. 250). Because autonomy entails a degree of creative license, we expect that the autonomous analyst should be more inclined to develop independent, innovative solutions than one who feels constrained to follow an established procedure (Janz and Prasarnphanich 2003, Parker et al. 2006).

**Hypothesis 3 (H3). Climate for autonomy is positively related to solution innovation.**

**KMS Access**

KMS access is consulting a KMS to learn about the organization’s pre-existing knowledge about a particular issue or problem. Alavi and Leidner (2001) describe knowledge management technologies as “actualizing” systems that work by “reinforcing knowledge processes” (p. 124). This suggests that KMSs are not expected to determine knowledge-related behaviors directly but rather to provide a supportive infrastructure that influences how they are achieved within an organizational context. However, although prior research has theorized a direct relationship between climate and knowledge management behaviors (Bock et al. 2005, Janz and Prasarnphanich 2003), little is understood about how KMS access moderates this relationship.

We expect KMS access to strengthen the relationship among perceived climate for innovation and both solution reuse and solution innovation. Consistent with Hypothesis 2, analysts should engage more actively in solution reuse if they perceive a climate that supports innovation through solution exchange among knowledge workers. Because a KMS enhances and streamlines such exchange (Markus 2001, Ofek and Sarvary 2001), higher levels of KMS access will augment the positive impact of an innovative climate on solution reuse. However, even when an existing solution cannot be reused directly, knowledge accessed in a KMS may still be leveraged. Some types of KMS may lead to a homogenization of knowledge (Kane and Alavi 2007), but KMS can also facilitate searches for novel solutions by providing a common space in which knowledge can be shared, transformed, and re-created (Nonaka and Konno 1998). Information systems can support and enhance knowledge creation by exposing individuals to more, and more diverse, organizational information (Alavi and Leidner 2001, Ofek and Sarvary 2001). Thus, a KMS not only provides a repository of ready-made solutions, but also constitutes a generative resource that can enhance creative behaviors fostered by a strong climate for innovation. Accordingly, we expect that

**Hypothesis 4 (H4). An increase in KMS access strengthens the relationship between climate for innovation and (a) solution reuse and (b) solution innovation.**

Although we anticipate that KMS access will intensify the effect of a climate for innovation on innovative behaviors, we expect that it will diminish the effect of a climate for autonomy on such behaviors. Consistent with H3, an autonomous analyst should engage more in innovative solution building and rely less on guidance from organizational sources (Cabrera et al. 2006, Janz and Prasarnphanich 2003). However, by providing a platform on which solutions are shared, a KMS tends to foster interconnecting ties among knowledge workers that, while enhancing analysts’ problem-solving efficiency, embody a degree of dependence on the knowledge and solutions of others (Levin and Cross 2004). Accessing a KMS, either to directly reuse knowledge or to seek ideas in developing an innovative solution, entails by its very nature a reliance on an organizational system and others’ knowledge to solve problems. Thus, although
increasing an analyst’s autonomy should, by itself, lead her to innovate more, introducing KMS access into her problem-solving processes should reduce the extent to which her autonomy leads her to engage in solution innovation.

**Hypothesis 5 (H5).** KMS access weakens the relationship between climate for autonomy and solution innovation.

Figure 1 summarizes our hypotheses.

### Research Methodology and Analysis

#### Sample and Data Collection

The sample population consisted of technical support analysts who use a KMS to support their work. To ensure a critical mass of knowledge in the KMS, we included only systems that had been in use for longer than one year. Potential sites were identified by asking a KMS vendor to provide contact information for organizations that use its product to support technical support analysts. The KMS vendor identified 26 companies that represented both “high” and “low” adopters of the KMS. The vendor sent these companies a letter describing the study, and two weeks later each company was called and invited to participate. Eight firms agreed to participate. One of these companies was disqualified because its KMS had been in use for less than a year. Characteristics of the remaining seven companies are shown in Table 1.

Following the initial contact, semistructured phone interviews lasting 30–40 minutes were conducted with the main contact and one or two KMS users at each site. These interviews enabled us to confirm that there was a significant investment in the KMS, both in terms of knowledge and financial resources. Either an individual or a group was responsible for validating newly submitted knowledge before it was made available in the KMS. To further ensure the validity of existing knowledge, obsolete entries were removed annually. Analysts at each company were permanent employees of their respective organizations, as opposed to being external technical support contractors. Use of the system was not required, and analysts had access to colleagues and printed manuals as alternative knowledge sources. Finally, no unusual organizational initiatives (such as a major new product release) were undertaken at the time of the study, and all firms used the same KMS. Thus, potentially confounding effects of situational and design factors were mitigated.

After the interviews, analysts received an email message from a manager introducing the study and, within two days, received a follow-up email from the researchers with a URL for a Web-based survey. Two reminders were emailed in the following month. All participating individuals had Internet access and were experienced Web users. Of the 150 respondents solicited, 110 returned usable responses, yielding an overall response rate of 73%. Table 1 shows the response rate for each company.

Participants’ ages averaged 42, with a range of 26–64. On average, analysts had worked for their company for 9 years (with a range of 1–37 years) and had been in their present positions for 5 years (with a range of 1–24 years). Of the respondents, 68% were Level I analysts (the less-senior analysts who have the first contact with a customer) and 32% were more experienced Level II analysts. Thirty five percent were females and 65% males.

#### Measures

Scales validated in prior work were adapted and combined with items created specifically for this study. All items were measured on seven-point Likert scales, with a score of 1 meaning strongly disagree and 7 meaning strongly agree. Measures of solution innovation and reuse were adapted from Gray and Meister (2006). Scales for climate of innovation and autonomy were adapted from Koys and DeCotiis (1991). Measures of KMS access were taken from Gray and Durcikova (2005–2006). To enhance measurement reliability, items were further refined through a card-sorting exercise and pretests with Ph.D. students, information systems faculty members, and managers from each participating company, per Moore and Benbasat (1991). Finally, we included measures of time pressure, seniority level, gender, and age to control for potential differences based on position (e.g., Level I/first-contact versus Level II/escalation), variation in the time-sensitivity of analyst work, and individual differences. The scale for time pressure was adapted from Koys and DeCotiis (1991). The level of seniority was a dummy variable representing whether the respondent was a Level I or Level II analyst.
A factor analysis was conducted using principal component extraction with varimax rotation. Any item not loading at least 0.6 on its respective construct was dropped. Retained items, loadings, and cross-loadings are shown in the appendix. The factor structure for the retained items confirmed both convergent and discriminant validity. Scale reliability was assessed with composite reliability (Werts et al. 1974) and Cronbach’s alpha scores, all of which exceeded the 0.7 value recommended by Nunnally (1978). All average variance extracted (AVE) values were above 0.50 (Table 2), and the square roots of AVE values (on the diagonal of Table 2) were greater than the off-diagonal correlations, indicating adequate convergent and discriminant validity (Fornell and Larcker 1981). Results of Harmon’s single-factor test (Podsakoff and Dalton 1987) and the marker variable test (Lindell and Whitney 2001) indicated that common-method bias was not present.2

To ensure that individual-level analysis was appropriate, SPSS mixed analysis was used to calculate fixed (Level 1) and random (Level 2) model effects for climate variables (Hayes 2006, Majchrzak et al. 2005). The Wald Z statistic, testing for significance of random effects, was nonsignificant for all climate variables (climate for innovation: Wald $Z = 1.04, p = 0.29$; climate for autonomy: Wald $Z = 0.48, p = 0.62$; time pressure: Wald $Z = 0.38, p = 0.35$), indicating that the relationships between the climate variables and outcomes do not differ significantly between organizations (Hox 2002). Intraclass correlations for each of the climate variables (0.15 for climate for innovation, 0.04 for climate for autonomy, and 0.03 for time pressure) were well below the 0.7 value recommended as a minimum for group-level analysis (Majchrzak et al. 2005). Together, these results supported individual-level analysis.

### Data Analysis and Results

We tested the hypotheses for solution innovation and solution reuse using separate hierarchical regression analyses. A three-step regression analysis was run: (1) the control variables were introduced, (2) the main effects were introduced, and (3) the moderating effect of KMS access was tested. Because moderating effects were tested, all data were standardized. Additionally, second-order interaction effects between the independent variables were considered to avoid erroneous interpretations of the results (Jaccard and Turrisi 2003). An examination of the variance inflation factor suggested that multicollinearity was not a major concern in the analysis, as all variance inflation factor values were less than or very close to 1. All decision variables were normally distributed. To confirm the robustness of our analysis, we ran bootstrapping (with 500 resamples) in partial least squares (see Preacher and Hayes 2008), which revealed no statistically significant differences in the results. Results are reported in Table 3.

The model explains 25.3% of the variance in solution innovation (where 6.8% is explained by the

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2 Harmon’s single-factor test revealed eight factors explaining 69% of the variance, with no single factor featuring significant ($p < 0.10$) loading for all items. The marker variable test showed that, after adjustment for the second-smallest positive correlation among the constructs, all originally significant correlations remained significant.
control variables) and 24.9% of the variance in solution reuse (where 15.3% is explained by the control variables).

H1, which predicted that climate for innovation would relate positively to solution innovation, was not supported ($\beta = 0.118$, n.s.). However, H2, which asserted that climate for innovation would relate positively to solution reuse, was supported ($\beta = 0.249, p < 0.05$). As predicted by H3, climate for autonomy was positively related to solution innovation ($\beta = 0.296, p < 0.001$). H4(a), which stated that KMS access would strengthen the relationship between climate for innovation and solution reuse, was not supported ($\beta = -0.051$, n.s.). However, H4(b), predicting that KMS access would strengthen the relationship between climate for innovation and solution innovation, was supported ($\beta = 0.224, p < 0.01$). Finally, H5, which argued that KMS access would weaken the relationship between climate for autonomy and solution innovation, was supported ($\beta = -0.275, p < 0.01$).

Figures 2 and 3 illustrate the nature of the interaction effects proposed in H4(b) and H5. Supporting H4(b), Figure 2 shows that climate for innovation has a positive effect on solution innovation at high levels of KMS access, but the effect becomes negative at low levels of KMS access. Conversely, as H5 asserts, Figure 3 shows that the effect of climate for autonomy on solution innovation is positive at low levels of KMS access, but the effect becomes negative at high levels.

The results from hypothesis testing are summarized in Figure 4.

Two out of four control variables—time pressure and analyst level—were significant in the model. Though Level I analysts tended to reuse solutions more frequently than Level II analysts, both engaged in significant solution innovation (mean response for solution innovation was 5.24, with standard deviation of 0.91). Time pressure had no effect on solution reuse but did positively affect solution innovation, indicating that analysts under time pressure tended to innovate more.

### Table 2: Means, Standard Deviations, Composite Reliability, AVE, and Interconstruct Correlations

<table>
<thead>
<tr>
<th>No.</th>
<th>Construct</th>
<th>Item count</th>
<th>Mean</th>
<th>SD</th>
<th>Composite reliability</th>
<th>$\alpha$</th>
<th>AVE</th>
<th>Constructs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KMS access</td>
<td>3</td>
<td>4.812</td>
<td>1.526</td>
<td>0.908</td>
<td>0.856</td>
<td>0.763</td>
<td>0.873</td>
</tr>
<tr>
<td>2</td>
<td>Climate for innovation</td>
<td>4</td>
<td>4.877</td>
<td>1.215</td>
<td>0.883</td>
<td>0.813</td>
<td>0.659</td>
<td>0.284</td>
</tr>
<tr>
<td>3</td>
<td>Climate for autonomy</td>
<td>4</td>
<td>4.743</td>
<td>1.164</td>
<td>0.847</td>
<td>0.764</td>
<td>0.580</td>
<td>0.031</td>
</tr>
<tr>
<td>4</td>
<td>Solution innovation</td>
<td>3</td>
<td>5.236</td>
<td>0.906</td>
<td>0.897</td>
<td>0.826</td>
<td>0.743</td>
<td>0.847</td>
</tr>
<tr>
<td>5</td>
<td>Solution reuse</td>
<td>2</td>
<td>4.436</td>
<td>1.148</td>
<td>0.837</td>
<td>0.784</td>
<td>0.822</td>
<td>0.265</td>
</tr>
<tr>
<td>6</td>
<td>Time pressure</td>
<td>3</td>
<td>4.370</td>
<td>1.379</td>
<td>0.862</td>
<td>0.759</td>
<td>0.677</td>
<td>0.030</td>
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<td>7</td>
<td>Level</td>
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<td>N/A</td>
<td>N/A</td>
<td>0.800</td>
<td>0.030</td>
<td>0.686</td>
</tr>
<tr>
<td>8</td>
<td>Gender</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>0.305</td>
</tr>
<tr>
<td>9</td>
<td>Age</td>
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<td>9.611</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*p ≤ 0.05; **p ≤ 0.01.

# Table 3: Regression Results

| DV: Solution innovation | | DV: Solution reuse | | | | | | | |
|-------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                         | Model 1                   | Model 2                   | Model 3                   | Model 1                   | Model 2                   | Model 3                   |
| Level                   | 0.082                     | 0.02                      | -0.021                    | -0.271                     | -0.258                     | -0.266                     |
| Gender                  | -0.049                    | -0.063                    | -0.075                    | 0.098                      | 0.062                      | 0.063                      |
| Age                     | -0.033                    | -0.06                     | -0.105                    | 0.111                      | 0.044                      | 0.03                       |
| Time pressure           | 0.237*                    | 0.337***                   | 0.376***                  | -0.226*                    | -0.069                    | -0.073                     |
| KMS access              | 0.012                     | 0.06                      | 0.111                     | 0.219                      | 0.249*                     |                             |
| Climate for innovation  | 0.006                     | 0.118                     | 0.219                     | 0.249*                     |                             |                             |
| Climate for autonomy    | 0.369***                  | 0.296***                  | 0.038                     | 0.037                      |                             |                             |
| KMS access * Climate for innovation | 0.224** |                             |                             | -0.051                     |                             |                             |
| KMS access * Climate for autonomy | -0.275** |                             |                             | -0.108                     |                             |                             |
| Climate for innovation * Climate for autonomy | 0.073 |                             |                             |                             |                             |                             |
| $R^2$                   | 0.068                     | 0.192**                   | 0.253**                   | 0.153**                    | 0.232**                    | 0.249**                    |
| Adj. $R^2$              | 0.031                     | 0.134                     | 0.178                     | 0.119                      | 0.144                      | 0.165                      |
| Model $F$               | 1.845                     | 3.290                     | 3.177                     | 4.499                      | 3.497                      | 2.629                      |
| $\Delta R^2$           | 0.123***                  | 0.061*                    | 0.079*                    | 0.144                      | 0.165                      |                             |
| $F$ change              | 1.845                     | 4.827                     | 2.746                     | 4.499                      | 2.765                      | 1.845                      |

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001.
Discussion

Implications for Research

Existing knowledge management and organizational literature lacks empirical studies that describe how climate interacts with KMS access to shape individual exploration/exploitation choices. The results of this study provide evidence that climate shapes individual-level exploration/exploitation behaviors, although sometimes in counterintuitive ways. Analysts’ solution reuse was positively influenced by climate for innovation (H2), which accords with prior research suggesting that innovative climates promote knowledge exchange (Chen and Huang 2007, Hoegl et al. 2003). However, solution innovation was influenced not by climate for innovation (H1) but by climate for autonomy (H3); this result corroborates the notion that autonomous employees are more likely to engage in creative behaviors (Cabrera et al. 2006, Parker et al. 2006) but fails to support the intuitive concept that climate for innovation should enhance solution innovation (Amabile et al. 1996). Though not definitive, these results suggest that support for autonomy, rather than for innovation itself, should be a key area of focus when studying knowledge workers’ propensity to create their own solutions to problems.

Another implication of our results is that KMSs can exert differential effects on exploration/exploitation depending on their interaction with particular climate dimensions. With respect to exploitation, prior research has generally argued that KMSs can enhance knowledge reuse (Kankanhalli et al. 2005, Markus 2001). However, our analysis failed to find evidence that KMSs either influenced solution reuse directly or magnified the relationship between climate for innovation and solution reuse H4(a). This outcome refines prior theory by showing that there may be cases where a KMS plays a smaller role in enhancing reuse behaviors than might commonly be assumed. For instance, studies on knowledge sourcing have shown that conditions of high intellectual demand lead knowledge workers to turn directly to colleagues for quick answers to difficult problems (Gray and Durcikova 2005–2006). Thus, in a turbulent and demanding environment like technical support, KMS access may have less impact on reuse because of the

![Figure 2 Interaction Effect of Climate for Innovation (CI) and KMS Access on Solution Innovation](image1)

*Note.* High: +2 SD; low: −2 SD; constructs standardized.

![Figure 3 Interaction Effect of Climate for Autonomy (CA) and KMS Access on Solution Innovation](image2)

*Note.* High: +2 SD; low: −2 SD; constructs standardized.
predisposition of analysts toward alternative knowledge channels. Additional investigation of the effects of KMS access on reuse behavior is needed to identify the conditions under which this effect is more or less pronounced.

With respect to the effect of a KMS on exploration, prior work has been unable to achieve consensus. Some work suggests that certain types of KMSs lead to a homogenization of knowledge that, over time, constrains innovative solutions (Kane and Alavi 2007). Other work suggests that KMSs act as idea-generating catalysts that can stimulate innovative solutions (Alavi and Leidner 2001, Ofek and Sarvary 2001). By incorporating the effects of climate on innovative behavior, our results offer a perspective that bridges these apparently contradictory hypotheses. Supporting the innovation-enhancing perspective, we found that the positive influence of an autonomous climate on solution innovation was weakened (and reversed in direction) when a KMS was accessed more frequently during problem solving (H5).

These results, illustrated in Figures 2 and 3, show that a KMS can have a differential impact on the effects of two climate variables that should both lead to greater solution innovation. In addition, the lack of support for H4(a) in light of support for H4(b) and H5 implies that, in an innovative climate, the presence of a KMS may influence individuals’ tendencies to engage in solution innovation more than their tendencies to engage in solution reuse. This contrasts with conventional wisdom that KMSs in technical support environments primarily promote solution reuse (e.g., Davenport and Klahr 1998) and calls for increased attention to the innovation-enhancing role that KMSs can play.

In general, the interaction effects of KMS access observed in this study (and the failure to detect direct KMS effects) suggest that KMSs do not directly determine exploration/exploitation behaviors but instead moderate the way these behaviors are shaped by individual climate perceptions. This moderating role of KMSs has been implicitly acknowledged in prior work (Alavi and Leidner 2001, Markus 2001) but has received little empirical scrutiny. Our results suggest that a KMS should not be considered a driver of exploration/exploitation behaviors, but as an enabler that is situated among other driving contextual fac-

Note. Supported hypotheses shown in bold. "p ≤ 0.05; "p ≤ 0.01; ""p ≤ 0.001.
tors. Insights can certainly be gained from simulation modeling approaches (e.g., Bray and Prietula 2007, Kane and Alavi 2007), but a complete understanding of how these behaviors unfold must also consider how climate directly influences individuals’ choices.

Finally, an unexpected yet interesting result reflecting the context of this study is that the analyst’s level did not significantly affect whether or not she innovates. Although one might assume that only higher-level analysts would have the time or ability to innovate and develop new solutions, our results suggest that analysts at all levels engage in exploratory behaviors. Solution innovation is even more pronounced when analysts perceive that they work under time pressure ($\beta = 0.376$, $p < 0.01$), indicating that when time is of the essence, creating new solutions may be a more efficient alternative than searching for previously established solutions. This observation is corroborated by the negative correlation between time pressure and both KMS access ($-0.320$, $p < 0.01$) and solution reuse ($-0.230$, $p < 0.05$). These results suggest that technical support work is a complex activity involving both routine and creative problem solving, even when performed under significant time and resource constraints by relatively low-level employees.

**Implications for Practice**

Knowledge management practitioners and managers should be aware that creating a positive climate for autonomy and climate for innovation can encourage solution reuse and innovation, but not necessarily in expected ways. A climate that encourages innovation may engender many types of innovative behavior beyond simply creating new solutions to problems, including the reuse of others’ solutions. Conversely, increasing the autonomy of knowledge workers seems to have more of an effect on their tendency to create new solutions than nurturing innovation directly does.

Practitioners should also be aware that the effects of KMSs may be more complex than they anticipate. KMS access in a technical support environment has no direct impact on the likelihood that individuals will reuse solutions. In an environment that supports innovation, KMS access does not seem to automatically enhance the degree to which knowledge is reused. Furthermore, the impact of KMS access on analysts’ propensity to develop new solutions may depend on characteristics of the work environment. KMS access increases the creative behavior of analysts who perceive support for innovation, but may decrease the innovative behavior of analysts who perceive themselves as highly autonomous. Managers should carefully consider both the desired outcomes of KMS access and the perceived climate of the organization when examining or anticipating the effects of KMS on exploration/exploitation behavior.

Overall, our study suggests that technical support involves more than just looking up routines in a manual. Rather, it involves a set of practices that are affected by the available infrastructure (e.g., a KMS), the work climate, and individual perceptions of the context, and the tools. Thus, information systems managers who assume that routinization and reuse are the primary building blocks of technical support work are likely to be surprised by the unrealized potential resulting from these practices alone.

**Limitations and Future Directions**

The use of cross-sectional survey data prevents an explicit assessment of causal relationships among constructs. Longitudinal data would provide stronger evidence of causal relationships and how they evolve over time. Measurement limitations include the use of a two-item scale for solution reuse and the use of subjective KMS access measures, which may introduce noise and bias into the analysis. Objective measures of KMS access could corroborate or refute subjective measures as valid behavioral indicators. Finally, although the sample included respondents from multiple organizations, the choice to focus on technical support potentially limits generalizability. However, because technical support exemplifies many of the characteristics of general knowledge work (Das 2003), we anticipate that the theoretical tenets of our model will hold in other knowledge management contexts that are similarly reliant on KMS-enabled knowledge reuse and innovation. Examples of such contexts might include consulting in a practice area, high-tech maintenance, and process design/optimization (Markus 2001).

This study uncovered questions that are worth investigating in future work. First, under what conditions do climate variables operate as observed in this study? For example, does a climate for innovation positively influence solution reuse rather than solution innovation in all circumstances, or are there specific knowledge management environments (e.g., less turbulent) in which an innovative climate can enhance solution innovation? How do the moderating effects of a KMS change in the presence or absence of alternative knowledge sources, such as colleagues or printed materials? Furthermore, how do these effects change over time as a KMS develops from a novelty to an embedded part of organizational infrastructure?
Finally, how do individual KMS-enabled individual exploration/exploitation behaviors combine to shape organizational capabilities and performance?

Conclusions

Exploration and exploitation have long been recognized as critical organizational activities; this study responds to a need to empirically investigate the factors that influence the individual behaviors underlying these activities. Our analysis shows that climate for innovation encourages exploitation, whereas climate for autonomy encourages exploration. Additionally, our results reveal that KMS access does not directly influence individuals’ exploration exploitation behaviors but either enhances or diminishes the effects of certain climate variables on these behaviors, a duality that can help reconcile the contrasting positions of extant research and orient continuing inquiry. Future research should build on these results to further examine how exploitation and exploration are influenced by KMS access and climate, and how these practices affect individual and organizational performance.

Appendix. Survey Items, Loadings, and Cross-Loadings

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Factor loadings and cross-loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>KMS access</td>
<td>I rarely use KMS as a way of acquiring knowledge (reverse coded).</td>
<td>0.838</td>
</tr>
<tr>
<td></td>
<td>I frequently check in KMS when I need to improve my knowledge on a topic or issue.</td>
<td>0.868</td>
</tr>
<tr>
<td></td>
<td>When I am working on a challenging problem, I often look in KMS to find solutions to similar problems.</td>
<td>0.858</td>
</tr>
<tr>
<td>Climate for innovation</td>
<td>My supervisor encourages me to develop my ideas.</td>
<td>0.127</td>
</tr>
<tr>
<td></td>
<td>This organization is always moving toward the development of new answers.</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>People in this organization try new approaches to tasks.</td>
<td>0.214</td>
</tr>
<tr>
<td></td>
<td>People in this organization use tried-and-true approaches to tasks (reverse coded).</td>
<td>0.032</td>
</tr>
<tr>
<td>Climate for autonomy</td>
<td>I make most of the decisions that affect the way my job is performed.</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>I determine my own work procedure.</td>
<td>-0.041</td>
</tr>
<tr>
<td></td>
<td>I schedule my own work activities.</td>
<td>-0.066</td>
</tr>
<tr>
<td></td>
<td>I organize my work as I see best.</td>
<td>0.079</td>
</tr>
<tr>
<td>Solution innovation</td>
<td>Innovativeness is a must in my work.</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>Most of the time I am quite innovative in solving work problems.</td>
<td>-0.069</td>
</tr>
<tr>
<td></td>
<td>I believe I am usually very creative in my solutions to work problems.</td>
<td>-0.089</td>
</tr>
<tr>
<td>Solution reuse</td>
<td>The majority of problems I deal with can be solved by applying previously developed solutions.</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>When I solve problems I often rely on existing solutions.</td>
<td>0.26</td>
</tr>
<tr>
<td>Time pressure</td>
<td>I have too much work and too little time to do it.</td>
<td>-0.032</td>
</tr>
<tr>
<td></td>
<td>I feel like I never have a day off.</td>
<td>-0.199</td>
</tr>
<tr>
<td></td>
<td>Many employees at my level get “burned out” by the demands of their jobs in this organization.</td>
<td>-0.197</td>
</tr>
</tbody>
</table>

Note. The highest factor loading for each item is shown in bold.
References


