UNDERSTANDING THE ROLE OF TRANSACTIVE MEMORY SYSTEMS AND KNOWLEDGE MANAGEMENT MECHANISMS ON TEAM PERFORMANCE

Completed Research Paper

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Abstract

Teams are increasingly faced with obstacles that can hurt their performance. Social cognitive skills are emerging factors that have shown the potential to influence how well team members work together. However, the interplay of transactive memory systems (TMSs) and knowledge management (KM) mechanisms within technology teams has not received much research attention. This paper examines the effects of a team’s TMS and KM mechanisms on the team’s performance. The hypotheses are tested using data from 54 teams within seven major US corporations. The results show knowledge creation to be more salient than knowledge sharing and application mechanisms, because only creation seems to affect team performance. Moreover, knowledge creation affects knowledge sharing, which affects knowledge application. Information Technology (IT) support and TMS both facilitate knowledge creation. TMS also affects knowledge application, whereas knowledge sharing only indirectly (through knowledge creation) depends on TMS and IT support. Theoretical and practical implications are offered.

Keywords: Teams, transactive memory systems, knowledge management, team performance
Introduction

In today’s knowledge-based networked economy much of the technology work is interdependent and teams dominate the means for getting the work done (Hughes and Terrell 2007; Zeidner et al. 2009; Zachary et al. 2009). Technology attributes, tasks, and activities are more complex, and thus the ability to leverage the collective skills and knowledge of individuals is important (Stein 2009). Moreover, organizational structures are flatter and as a result there is an accelerated need for greater coordination and collaboration across teams and work groups. A team is defined “… as a set of two or more individuals that adaptively and dynamically interacts through specified roles as they work toward shared and valued goals” (Salas et al. 2009, p. 40). Companies value and need the capability of teams (Salas et al. 2010) and are challenged to create high-performance teams working well together (Laszlo et al. 2009). Thus, the collective contributions (teamwork) of individuals to perform the work enable companies to reach their goals.

As companies search for greater competitive advantage, they seek ways to enhance the performance and the efficiency of their teams’ knowledge creation process. Many firms use their teams as the basic knowledge creation unit across their organizations (Jones and Jordan 1998; Leonard-Barton and Swap 1999). For example, according to Smith et al. (2005), the rate of new product introduction is a function of a firm’s ability to manage, maintain, and create knowledge (Cohen and Levinthal 1990; Drazin and Rao 2002). Moreover, the knowledge creation process has played a critical role in the formulation and activation of entrepreneurial orientation of firms (Li et al. 2008), business value of knowledge assets (Teece 1998), supply chains (Wu 2008), and information technology organizations (Lee and Choi 2003).

Prior research has shown consistent outcomes for knowledge management and social cognitive behavior to influence creativity and innovation in teams leading to performance gains (Ancona and Caldwell 1992; Pirolla-Merlo and Mann 2004; Majchrzak et al. 2004). Piperopoulos (2010) suggest that the capacity to build on creative power and the human mind converted into production and services is the critical core competence of any organization. Team performance, knowledge integration, coordinated actions, and efficient communication are essential, measurable and account for the fundamental components of teamwork (Mesmer-Magnus and DeChurch 2009; Salas et al. 2009). It has been argued knowledge creation and information distribution are more important when the emphasis is to build an active and dynamic understanding of the organization (Nonaka 1994).

It is natural to assume when interactions between individuals are organized in a collective capacity, they can become disrupting and inhibit overall performance. The lack of harmony in teamwork within an organization can potentially generate distracting behaviors such as insecurity and mistrust, limited sharing of information or resources, purposeful non-cooperation, unproductive communication, and overall poor performance (Leenders et al. 2003; Browning and Kanaga 2007). For example, teamwork is especially important within the internal value chain of a company where core functions of the organization and key processes are executed. Teamwork mechanisms can make the parts of the operational activities run smoothly. While incorrect or lack of information can happen when a team member doesn’t know about a planned team meeting and does not attend. The absence can limit the team’s capability and jeopardize the team’s progress. Other sources of conflict may occur when team members hoard information that should be shared stifling team performance. Most importantly, the complex nature and advances in technology work identify the need to further develop ways, which team performance can be improved. Such improvements can be leveraged through abilities gained from social cognitive skills (Cherniss and Adler 2000; Slaughter et al. 2009 Zachary et al. 2009).

Prior research has found that talent, energy, and skills when harnessed collectively increase the capacity for technology innovation and productivity (Choi et al. 2010; Barczak et al. 2010). Members of diverse teams (e.g., a cross functional team) possess knowledge in different domains or business specialties, and this creates dissimilarities in their world views, languages, and expressed communication (Dougherty 1992). These behaviors are amplified as teams’ unique perspectives arise, resistance to accept new ideas, or inability to effectively interact with other relevant colleagues in the team (Anand et al. 2003). Existing research suggests that such teams take longer and encounter frequent difficulties in integrating their different knowledge stores to reach a consensus and solve problems because of misperceptions, poor mutual understanding, and inhibited information sharing (e.g. Gruenfeld et al. 1996; Jackson et al. 2003).
Several scholars have demonstrated how the abilities gained through social cognitive processes affect team performance (Faraj and Sproull 2000; Kanawattanachai and Yoo 2007; Van der Vegt and Bunderson 2005). Collaborative social cognition within KM mechanisms (Choi et al. 2010) and TMS (Choi et al. 2010; Cruz et al. 2007) are emerging factors influencing team performance (Cannon-Bowers and Salas 1998). Scholars who study team cognition have addressed the need to analyze the interplay between team-specific attributes, creation and utilization of team knowledge (e.g., Fiore et al. 2001; Smith-Jentsch et al. 1998), however little research to date has examined the collaborative social cognition and knowledge mechanisms impact on team performance. Therefore, this study will offer a more comprehensive and broad understanding of KM processes that includes creation, sharing, and application as amplified in team performance. The research model in Figure 1 shows the relationship for the constructs of interest in this study.

**Theory and Hypotheses**

Knowledge management refers to identifying and leveraging the collective knowledge in an organization to foster competitive advantage (von Krogh 1998). It continues to be problematic and a concern for organizations to create, share, and apply knowledge (Alavi and Leidner 2001; Gold 2001; von Krogh 2012). The KM process provides firms the ability to capitalize their embedded knowledge and transfer the knowledge into operational benefit and business value (Nonaka and Takeuchi 1995). Based on the theory of knowledge creation, knowledge is created through a spiral process of socialization, externalization, combination, and internalization (SECI)(Nonaka 1994). Therefore, KM and in particular the knowledge creation plays a critical role facilitating the sharing of knowledge assets within an organizations’ teams.

**Transactive Memory Systems and Knowledge Creation in Teams**

This study builds on recent research (Choi et al. 2010) to examine the socio-cognitive structure known as a transactive memory system (TMS) and its role on KM capabilities leading to performance. A TMS focuses on the collective behaviors for encoding, storage, and retrieval of knowledge from different domains (Wegner 1987). TMS facilitates access to a greater amount of knowledge, encourages knowledge sharing among team members to cultivate specialized expertise, benefit group decision making and performance in organizational teams (Lewis 2003). Teams are an important mechanism that can recombine knowledge from different individuals to build collective knowledge. Past studies on TMSs show...
Knowledge Management and Business Intelligence

this cognition as an important antecedent that affects team performance under varying conditions (Kanawattanachai and Yoo 2007; Ren et al. 2006; Majchrzak et al. 2004). Teams can benefit from strategies that improve their transactive memory systems and knowledge capabilities. Many firms use their teams’ basic knowledge creation for competitive advantage. Thus, TMS will affect knowledge creation.

H1: TMS will influence knowledge creation

Knowledge Creation and Team Performance

A team’s performance is the extent that the team meets its established quality, quantity, and flexibility objectives (Hoegl and Parboteeah 2003). When a team utilizes KM mechanisms, a stronger coordination is formed (Rico et al. 2008) and team capabilities increase. Consequently, the knowledge is available, becomes broader, intensifying understanding (Alavi and Tiwana 2002). Team members are then able to recognize when other team members need information, anticipate and predict the needs of their fellow team members. Their knowledge mechanisms facilitate the relationships among the work the team is engaged in and how they will interact (Sims et al. 2005).

The ability of companies to realize the value from their collection of knowledge and IT assets is key to their performance. A team is an important mechanism that combines the knowledge from different individuals to build collective knowledge. Knowledge capability depends on the extent that team members share and combine their knowledge resulting in knowledge sharing and combination where benefit cannot be gained in isolation (Nonaka and Takeuchi 1995). Leveraging the resource-based perspective, team knowledge is a critical resource for sustaining competitive advantage (Ohuysen and Eisenhardt 2002; Tiwana and McLean 2005). The theory of organizational knowledge creation puts forth that knowledge creation takes place when all four modes of knowledge conversion form a continual cycle triggered by such actions as team interactions, dialogue, coordination, documentation, experimentation, and learning by doing (Nonaka 1994).

Contrary to their expectation, (Choi et al. 2010) found knowledge sharing does not have a direct impact on team performance. They found that knowledge application has a positive impact on team performance. These relationships are not the focus of this study and will not be hypothesized. Thus, knowledge creation emerges as a necessary core competency of teams working together in organizations to influence knowledge sharing.

H2: Knowledge creation will influence team performance

Information Technology Support and Knowledge Creation

IT support plays an important role in leveraging the team knowledge resources within organizations (Sambamurthy and Subramani 2005). Many organizations utilized information systems that are specifically designed for collaborative sharing of information in a formal or informal manner (Alavi and Leidener 2001). A wide variety of collaborative tools and it’s functionally support the creation of new knowledge (Wasko and Faraj 2005; Wenger 1998) and is managed by technology support (Choi et al. 2010). Information technology enables brainstorming, especially in teams that are dispersed geographically, and also facilitates the incorporation of diverse perspectives while maintaining confidentiality (and thereby reducing the desire to comply with more authoritative individuals rather than express own views), consequently enabling greater knowledge creation (Sabherwal and Sabherwal 2005). Thus, it is hypothesized that IT support will influence knowledge creation.

H3: IT support will influence knowledge creation

Knowledge Creation and Knowledge Sharing

“Knowledge does not exist in just the cognition” (Nonaka and Toyama, 2003, p.6). Knowledge creation is acknowledged as the pre-requisite for effective sharing of knowledge. As the knowledge creation expands and spiral it moves through interactions that transcend organizational boundaries. The time and space, which the knowledge creation occurs plays a role to explain how the knowledge transforms into meanings and contexts. This space is characterized when individuals within teams interact with their environment to bring about an interchange of knowledge. It is through these interactions teams bring about their shared contexts and create meaning to amplify new knowledge (Nonaka 1994).
In order to enhance their performance, team members need to build consensus utilizing their expertise and abilities. Previous studies have found that knowledge creation capability enhances how organizations evolve and adapt to their environments (Smith et al. 2005; Cohen and Levinthal 1990). Smith et al. (2005) research demonstrated that the rate of new product and service introductions was attributed to the organizations’ members’ ability to combine and exchange knowledge. Kogut and Zander (1992) emphasizes how new knowledge leads to the generation of novel organizational outcomes. When individuals in teams have built shared understanding and integrate into diverse knowledge bases, innovation occurs (Schulze and Hoegl 2006; Sabherwal and Sabherwal 2005). Therefore, we posit:

H4: Knowledge creation will positively influence knowledge sharing

**Sample and Participants**

Fifty-four teams were studied representing seven Fortune 100 companies, located in the southern United States. The companies span across several industries, which include food, transportation, technology and marketing services, healthcare, and manufacturing. Each team was asked to complete an on-line survey anonymously. The average team size was approximately 11 (s.d. 8.8).

Of the 478 participant responses attempted, 123 responses were deleted due to incomplete data. All analyses were provided using a random selected informant from each team. The sample consisted of 355 participants. The average age of the individuals in the sample was 42.2 years; 65 percent were male; and 57 percent possessed at least a four-year college degree. The average job experience was 11.78 years, while the average team tenure was 5.5 years.

**Measurement**

All constructs included in this study were operationalized with published scales that have demonstrated good psychometric properties in earlier studies. The items were Likert-type 7-point scales with 1 indicating completely disagree and 7 indicating completely agree with the statements.

*Team transactive memory system* was measured using six items developed by Lewis (2003). The individuals were asked to rate their team’s TMS based on their interactions with others on the team.

*IT support for KM practices* was measured as a formative construct using four items from Lee and Choi (2003) to present distinctly different functions of IT that support KM practices. Individuals rated their perceptions of their organization’s IT support with respect to collaboration, communication, storage, search, and access of information.

*Knowledge creation* was measured with Smith et al. (2005) scale used in research of knowledge creation capability in organizations. The items invoke that for effective exchange and combination to occur, individuals must: 1) have access to people or groups with specialized information 2) be able to absorb and combine information that has been exchanged (combination capability) and 3) anticipate value from the exchange and combination process.

*Knowledge sharing* is based on the knowledge sharing intention measured by Bock et al. (2005). Choi (2010) modified items were used to measure individuals’ perceptions of the degree that their team members share different forms of knowledge.

*Knowledge application* was based on a three-item scale for on the knowledge application capability measure developed by Gold et al. (2001) and modified by Choi et al. (2010) to capture the team setting and to measure knowledge application within a team.

*Team performance* was captured based on team member’s ratings about their performance on ten dimensions: technical innovation, quality, and mission fulfillment. The analysis yielded three factors; the three dimensions present an overall reflective measure of the individual’s perception of team performance. The indicators were averaged to create a composite score.

Control variable. *Team size* was measured as reported by the informant team member.

**Analysis and Results**

Various tests to assess construct validity and reliability of the instrument. The Exploratory Factor analysis (EFA) was performed separately for the independent and dependent variables. Alternative EFA analysis can be used to structure items for the collective representation of an expressed concept where structure
encompasses the interrelatedness among variables allowing for the specification of a smaller number of factors of the original set of variables (Hair 2006). The results of the independent variables are Appendix A to represents the KM mechanisms, and Appendix B represents the dependent variable of interest. A seven factor structure emerged after removing cross-loading items and items loading below .5 (Hair 2006). The factors loaded on to their respective constructs, which thereby affirmed convergent validity and unidimensionality of the constructs.

For the formative construct IT support, traditional methods of assessing reliability such as internal consistency (e.g., composite reliability) and validity (e.g., AVE) are not appropriate (Bollen 1989). In lieu of traditional methods, examining the significance of item weights is recommended (Marcoulides 1998). In order to test the construct validity of the formative measure (IT support), first inspected were the weight of each item in the inner model following the recommendation of Petter et al. 2007. As shown in Table 1, all the weights were statistically significant at the target construct. Petter et al. 2007 also suggest that the VIF (variance inflation factor) score for formative constructs should be within less than 3.3. All factors of the study show VIF scores of less than 3.3. Therefore, the analysis reveals no multicollinearity among items for the formative constructs in the study.

<table>
<thead>
<tr>
<th>IT Support</th>
<th>Weights</th>
<th>Indicator</th>
<th>Loading</th>
<th>VIF</th>
<th>T-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>~0.0544</td>
<td>ITS1</td>
<td>0.5837</td>
<td>1.59</td>
<td>5.2307***</td>
<td></td>
</tr>
<tr>
<td>0.4782</td>
<td>ITS2</td>
<td>0.7276</td>
<td>2.85</td>
<td>12.8561***</td>
<td></td>
</tr>
<tr>
<td>0.2086</td>
<td>ITS3</td>
<td>0.9139</td>
<td>2.67</td>
<td>8.5929***</td>
<td></td>
</tr>
<tr>
<td>0.3852</td>
<td>ITS4</td>
<td>0.9035</td>
<td>2.75</td>
<td>13.1326***</td>
<td></td>
</tr>
</tbody>
</table>

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

**Test of Common Method Bias and Survey data**

First, the multiple respondents (team leader and team members) were used for data collection to minimize the threat of common method bias. Second, a Harman’s post hoc single-factor analysis was conducted to examine for method bias in the data. If common method variance is a serious issue, a factor analysis would generate a single factor accounting for most of the variance (Podsakoff et al. 2003). An EFA of all 45 indicators generated for one distinct factor, and the extracted factor explained 37.5 percent of the variance. This diagnostic analysis indicates that common method bias is unlikely to be an issue with the data.

Discriminant and convergent validities indicate whether the measures of constructs are distinct and the various indicators load on intended constructs. To evaluate discriminant validity, Fornell and Larcker (1981) suggest comparing AVE with the square of the correlations among the latent variables. The correlations among indicators of a construct should be greater than across constructs. Based on the item loadings, 7 ICR values for knowledge creation, knowledge sharing, knowledge application, and team performance were satisfactory (Table 2). ICR values could not be computed for IT support, which was measured using formative indicators. The item correlations (demonstrate discriminant validity for the constructs and factor loadings (Table 2) also help assess discriminant validity (Marcoulides 1998).
Table 2. Correlation and Reliability of Latent Constructs
(Square-root of Average Variance Extracted along the diagonal)

<table>
<thead>
<tr>
<th>Constructs</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IT Support (formative indicators)</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Knowledge Application</td>
<td></td>
<td>0.35**</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Knowledge Creation</td>
<td></td>
<td>0.73***</td>
<td>0.49***</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Knowledge Sharing</td>
<td></td>
<td>0.25*</td>
<td>0.52***</td>
<td>0.38**</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>5. Team Performance</td>
<td></td>
<td>0.64***</td>
<td>0.26*</td>
<td>0.68***</td>
<td>0.15</td>
<td>0.91</td>
</tr>
<tr>
<td>6. Transactive Memory System</td>
<td></td>
<td>0.55***</td>
<td>0.40***</td>
<td>0.56***</td>
<td>0.13</td>
<td>0.55***</td>
</tr>
<tr>
<td>Cronbach Alpha</td>
<td>n/a</td>
<td>0.96</td>
<td>0.96</td>
<td>0.82</td>
<td>0.78</td>
<td>0.89</td>
</tr>
<tr>
<td>Range of Factor Loadings</td>
<td>n/a</td>
<td>.90-.97</td>
<td>.88-.93</td>
<td>.92-.92</td>
<td>.90-.92</td>
<td>.87-.93</td>
</tr>
<tr>
<td>Composite Reliability</td>
<td>n/a</td>
<td>0.97</td>
<td>0.97</td>
<td>0.92</td>
<td>0.90</td>
<td>0.93</td>
</tr>
<tr>
<td>AVE</td>
<td>n/a</td>
<td>0.88</td>
<td>0.81</td>
<td>0.85</td>
<td>0.82</td>
<td>0.82</td>
</tr>
<tr>
<td>VIF</td>
<td>n/a</td>
<td>1.86</td>
<td>3.11</td>
<td>2.04</td>
<td>2.22</td>
<td>3.20</td>
</tr>
<tr>
<td>Number of items</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

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

The PLS analysis was started with the theoretical model, two exogenous latent construct (team transactive system, and IT Support) and four latent endogenous constructs. The results for the emergent model are given in Figure 2. Paths TMS to knowledge creation (H1) and IT Support (H3) were supported (t=2.16 and 4.90, respectively). Paths knowledge creation to Team Performance (H2) and Knowledge Creation to Knowledge Sharing (H4) were supported (t=2.96 and 2.74, respectively).

The role of knowledge creation in the presence of knowledge sharing and application emerges as the most salient factor in this model. These results are evidence of the importance and role of knowledge creation.
in the knowledge process with TMS as its antecedent. In Table 3 are the summarized results of the hypothesis testing.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Relations</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>TMS -&gt; KCreate</td>
<td>Supported</td>
</tr>
<tr>
<td>H2</td>
<td>KCreate -&gt; TMPerf</td>
<td>Supported</td>
</tr>
<tr>
<td>H3</td>
<td>IT Support -&gt; KCreate</td>
<td>Supported</td>
</tr>
<tr>
<td>H4</td>
<td>KCreate -&gt; KShare</td>
<td>Supported</td>
</tr>
<tr>
<td>Choi et al. 2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H5</td>
<td>TMS -&gt; KShare</td>
<td>Not supported</td>
</tr>
<tr>
<td>H6</td>
<td>IT Support -&gt; TMS</td>
<td>Supported</td>
</tr>
<tr>
<td>H7</td>
<td>TMS -&gt; KApp</td>
<td>Supported</td>
</tr>
<tr>
<td>H8</td>
<td>IT Support -&gt; KShare</td>
<td>Not supported</td>
</tr>
<tr>
<td>H9</td>
<td>IT Support -&gt; KApp</td>
<td>Not supported</td>
</tr>
<tr>
<td>H10</td>
<td>KShare -&gt; KApp</td>
<td>Supported</td>
</tr>
<tr>
<td>H11</td>
<td>KShare -&gt; TMPerf</td>
<td>Not supported</td>
</tr>
<tr>
<td>H12</td>
<td>KApp -&gt; TMPerf</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

Our results differ from those obtained by Choi et al. (2010). More specifically, Choi et al. tested H5 to H12 indicated in Table 4, and found support for all of these hypotheses except H11 (knowledge sharing to team performance), whereas we only found support for three out of their eight hypotheses (H5-H12 above), i.e., H6 (IT support to TMS), H7 (TMS to knowledge application), and H10 (knowledge sharing to knowledge application). To some extent, this could be due to our addition of knowledge creation, which was not included in Choi et al.

To examine whether the different results could be attributed to the addition of knowledge creation, we have conducted some additional analysis by excluding knowledge creation, and retesting the resulting model. The results (that are reported in Table 4) were now much more similar to those obtained by Choi et al., with only two differences: (1) the path from IT Support to knowledge application was significant in Choi et al., but not with our dataset; (2) the path from knowledge sharing to team performance, which was not significant in Choi et al., is significant with our dataset.
Together, the results related to our expanded model (Table 4) and the theoretical model from Choi et al. (Table 4) indicate that the different results that have been obtained here are mainly due to the inclusion of knowledge creation, further highlighting the value of considering it.

**Discussion**

In this study, the impact of KM capabilities, in particular knowledge creation impact on team performance within organizations was explored. The team transactive memory systems show positive results on the knowledge creation process, which in turn influence team performance. IT support for KM only directly influences knowledge creation and not knowledge sharing and application, which are affected indirectly through knowledge creation. This is a significant contribution to the understanding of the importance of knowledge creation capability within teams. These findings suggest that as organizations’ seek to improve team performance; knowledge creation should be considered a crucial aspect of the KM process. These results confirm prior literature (e.g., Smith et al. 2005) emphasizing the importance of knowledge creation.

**Theoretical Contributions and Implications for Research**

The results of this paper reveal several findings that have important theoretical contributions and implications for research. The study makes several theoretical contributions that hold important implications for teams’ research in general and KM research in particular. First, this study is one of the few to empirically examine effects of TMS and IT support on team performance through KM mechanisms. Although evidence exists that KM influences team performance, this study distinguishes the KM dimensions that are most relevant. The knowledge creation is overwhelmingly salient in the presence of knowledge sharing and application capabilities leading only to team performance. Additionally, IT support for KM influences knowledge creation but not knowledge sharing and knowledge application. This finding is consistent with prior studies to support the effectiveness of IT support in KM practices (Alavi and Liedner 2001) and its influence on the way team members utilize various KM systems (Wang 2010). Moreover, knowledge creation influences knowledge sharing. Logically, sharing and application of knowledge follows the creation of knowledge. Team size was a control variable and its impact on team performance was not significant.

Knowledge creation is the first phase where new knowledge occurs. Thus, team transactive memory plays a significant role on knowledge creation capability as a team begins to assimilate and organize their knowledge interactions. This indicates that knowledge sharing and application may be less influential on
team performance when knowledge creation is considered. This finding supports prior literature to emphasize socialization factors as important for the early phases of knowledge development (Schulze and Hoegl 2006).

**Limitations**

The sample size was relatively small (n=54), and the research used the data from a single informant for a given team. A larger sample of more teams may provide a better representation of the population of technology teams. However, the research study theoretical model provide strong validation of theory related to prior research (Choi et al. 2010) to interpret the findings in this study. Most importantly, this study advances prior theory to capture an overlooked aspect of KM capability within collective social cognition.

The use of multiple informants from the same team could provide further insights into the team dynamics to increase the reliability and validity of team analysis. The sample was conducted with US companies, thus providing an aspect of diversity not utilized in Choi et al. 2010. This study extends their findings theoretical model to address the behaviors in a less collective culture and in organizations with perhaps weaker organizational norms surrounding KM.

Knowledge sharing could be argued to affect knowledge creation, whereas, in this paper, knowledge creation has been argued to affect knowledge sharing. Similarly, an argument could be made that applying knowledge would increase its perceived value, leading to subsequent greater sharing of that knowledge. Thus, alternative causal directions are indeed possible. This paper is limited in that we have considered the causal direction from creation to sharing to application, but not theorized– or empirically tested – alternative causal models.

**Practical Implications**

This study also provides some valuable practical implications for firms to improve their knowledge creation capabilities. The findings indicate a positive impact on knowledge creation capability on team performance, while knowledge sharing and application are less influential. Thus, firms should pay attention to their organizational team knowledge creation capabilities to harness their knowledge capacity. To advance their knowledge creation capabilities, they should develop team skills with the characteristics of high collectivism. If the organizational team culture does not meet such characteristics, firms should promote strategies not only emphasizing technical skills, but social cognitive behaviors. Since knowledge creation is the initial step to creating new knowledge, firms should cultivate programs that emphasis a collaborative cognition focus.

**Directions for Future Research**

Future research should more closely examine the role of the transactive memory systems and other social cognitive skills on team performance. Past research shows that both organizational norms and culture have a significant impact on knowledge capabilities (Bock, et al. 2005; Yoo and Lyttinen 2007; Gold, et al. 2001). Therefore, further examination into the role of these factors would enhance the understanding of team behaviors. An interesting aspect would be to consider how organizational factors facilitate the collective knowledge capability mechanisms. Further research is also needed to examine alternative causal models, such as including effects of knowledge sharing on knowledge creation. Such future research would benefit considerable from longitudinal data to explicitly test reciprocal effects.

**Conclusion**

This study offers some potentially important insights. First, knowledge creation appears to be an important knowledge management process in terms of influencing team performance. Moreover, the inclusion of knowledge creation in the nomological model seems to reduce the effects of knowledge sharing and application on team performance. Finally, the effects of IT support on knowledge sharing and application seem to be mediated by knowledge creation. Overall, this study advances knowledge creation as a specific KM capability mechanism that may be crucial for enhancing team performance.

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References


Appendix A: Results of Exploratory Factor Analysis for Knowledge Management, Transactive Memory Systems, and IT Support

<table>
<thead>
<tr>
<th>Knowledge Sharing: KS</th>
<th>Knowledge Application: KA</th>
<th>Knowledge Creation: KC</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMS</td>
<td>ITS</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>S.D.</th>
<th>TMS</th>
<th>ITS</th>
<th>KC</th>
<th>KA</th>
<th>KS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMS2 -Our team members are comfortable accepting procedural suggestions from other team members.</td>
<td>5.09</td>
<td>1.51</td>
<td><strong>0.86</strong></td>
<td>0.19</td>
<td>0.16</td>
<td>0.05</td>
<td>0.02</td>
</tr>
<tr>
<td>TMS3 -Our team members trust that other members’ knowledge about the project is credible.</td>
<td>5.04</td>
<td>1.47</td>
<td><strong>0.93</strong></td>
<td>0.19</td>
<td>0.23</td>
<td>0.13</td>
<td>0.07</td>
</tr>
<tr>
<td>TMS4 -Our team members are confident of relying on the information that other team members bring to the discussion.</td>
<td>4.59</td>
<td>1.64</td>
<td><strong>0.92</strong></td>
<td>0.05</td>
<td>0.44</td>
<td>0.36</td>
<td>-0.10</td>
</tr>
<tr>
<td>ITS1 -Our team is provided with IT support collaborative work regardless of time and place.</td>
<td>4.91</td>
<td>1.57</td>
<td>0.04</td>
<td><strong>0.57</strong></td>
<td>0.14</td>
<td>0.16</td>
<td>0.02</td>
</tr>
<tr>
<td>ITS2 -Our team is provided with IT support for communicating among team members.</td>
<td>6.09</td>
<td>0.98</td>
<td>0.22</td>
<td><strong>0.90</strong></td>
<td>0.54</td>
<td>-0.02</td>
<td>0.13</td>
</tr>
<tr>
<td>ITS3 -Our team is provided with IT support for searching and accessing necessary information.</td>
<td>6.06</td>
<td>0.86</td>
<td>0.36</td>
<td><strong>0.95</strong></td>
<td>0.38</td>
<td>0.17</td>
<td>0.09</td>
</tr>
<tr>
<td>ITS4 -Our team is provided with IT support for systematic storing.</td>
<td>1.45</td>
<td>1.45</td>
<td>0.17</td>
<td><strong>0.86</strong></td>
<td>0.45</td>
<td>0.12</td>
<td>0.03</td>
</tr>
<tr>
<td>KS1 -Our team members share their work reports and official documents with other team members.</td>
<td>4.65</td>
<td>1.26</td>
<td>-0.09</td>
<td>0.06</td>
<td>0.22</td>
<td>0.27</td>
<td><strong>0.92</strong></td>
</tr>
<tr>
<td>KS2 -Our team members provide their manuals and methodologies for other team members.</td>
<td>4.91</td>
<td>1.28</td>
<td>0.09</td>
<td>0.05</td>
<td>0.12</td>
<td>0.33</td>
<td><strong>0.92</strong></td>
</tr>
<tr>
<td>KA1 -Our team members apply knowledge learned from experience.</td>
<td>4.81</td>
<td>1.29</td>
<td>0.08</td>
<td>0.06</td>
<td>0.31</td>
<td><strong>0.91</strong></td>
<td>0.23</td>
</tr>
<tr>
<td>KA2 -Our team members use knowledge to solve new problems.</td>
<td>5.31</td>
<td>1.16</td>
<td>0.12</td>
<td>0.13</td>
<td>0.18</td>
<td><strong>0.97</strong></td>
<td>0.18</td>
</tr>
<tr>
<td>KA3 -Our team members apply knowledge learned from others.</td>
<td>5.13</td>
<td>0.97</td>
<td>0.16</td>
<td>0.13</td>
<td>0.17</td>
<td><strong>0.92</strong></td>
<td>0.16</td>
</tr>
<tr>
<td>KA4 -Our team members apply knowledge to solve new problems.</td>
<td>5.19</td>
<td>0.99</td>
<td>0.10</td>
<td>0.11</td>
<td>0.14</td>
<td><strong>0.95</strong></td>
<td>0.18</td>
</tr>
<tr>
<td>KCC1 -Team members are proficient at combining ideas.</td>
<td>5.2</td>
<td>0.96</td>
<td>0.26</td>
<td>0.38</td>
<td><strong>0.88</strong></td>
<td>0.32</td>
<td>0.04</td>
</tr>
<tr>
<td>KCC3 -Team members are proficient at creating opportunities.</td>
<td>5.76</td>
<td>1.13</td>
<td>0.23</td>
<td>0.18</td>
<td><strong>0.87</strong></td>
<td>0.14</td>
<td>0.06</td>
</tr>
<tr>
<td>KCC5 -Team members are capable of sharing their expertise to bring new projects or initiatives to fruition.</td>
<td>6.00</td>
<td>0.91</td>
<td>0.10</td>
<td>0.18</td>
<td><strong>0.88</strong></td>
<td>0.27</td>
<td>-0.05</td>
</tr>
<tr>
<td>KCC6 -Team members have learned to effectively pool their ideas and knowledge.</td>
<td>5.94</td>
<td>0.83</td>
<td>0.29</td>
<td>0.36</td>
<td><strong>0.92</strong></td>
<td>0.21</td>
<td>-0.04</td>
</tr>
<tr>
<td>KCPV1 -Team members see benefits from exchanging ideas with one another.</td>
<td>5.61</td>
<td>0.96</td>
<td>0.19</td>
<td>0.19</td>
<td><strong>0.94</strong></td>
<td>0.18</td>
<td>0.25</td>
</tr>
<tr>
<td>KCPV2 -Team members see benefits from combining ideas with one another.</td>
<td>5.78</td>
<td>1.06</td>
<td>0.10</td>
<td>0.22</td>
<td><strong>0.91</strong></td>
<td>0.12</td>
<td>0.30</td>
</tr>
<tr>
<td>KCPV4 -Team members believe that by exchanging ideas they can create value for this company.</td>
<td>5.61</td>
<td>1.04</td>
<td>0.16</td>
<td>0.22</td>
<td><strong>0.89</strong></td>
<td>0.16</td>
<td>0.36</td>
</tr>
</tbody>
</table>
Appendix B: Exploratory Factor Analysis for Team Performance

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>S.D.</th>
<th>Quality</th>
<th>Mission Fulfillment</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMPrate2- To what extent do you agree that your team performed well in terms of the following: Quality</td>
<td>6.09</td>
<td>0.83</td>
<td>0.22</td>
<td>0.01</td>
</tr>
<tr>
<td>TMPrate3- To what extent do you agree that your team performed well in terms of the following: Technical innovation</td>
<td>5.8</td>
<td>1.01</td>
<td>0.86</td>
<td>0.22</td>
</tr>
<tr>
<td>TMPrate6- To what extent do you agree that your team performed well in terms of the following: Work excellence</td>
<td>6.13</td>
<td>0.83</td>
<td>0.87</td>
<td>0.25</td>
</tr>
<tr>
<td>TMPrate1- To what extent do you agree that your team performed well in terms of the following: Efficiency</td>
<td>5.81</td>
<td>0.78</td>
<td>0.22</td>
<td>0.80</td>
</tr>
<tr>
<td>TMPrate4- To what extent do you agree that your team performed well in terms of the following: Adherence to schedules</td>
<td>5.65</td>
<td>1.12</td>
<td>0.22</td>
<td>0.77</td>
</tr>
<tr>
<td>TMPrate5- To what extent do you agree that your team performed well in terms of the following: Adherence to budgets</td>
<td>5.65</td>
<td>1.07</td>
<td>0.06</td>
<td>0.76</td>
</tr>
<tr>
<td>TMPrate8- To what extent do you agree that your team performed well in terms of the following: Mission fulfillment</td>
<td>6.00</td>
<td>1.03</td>
<td>0.18</td>
<td>0.82</td>
</tr>
<tr>
<td>TMPrate9- To what extent do you agree that your team performed well in terms of the following: Ability to resolve conflicts</td>
<td>5.81</td>
<td>1.32</td>
<td>0.06</td>
<td>0.91</td>
</tr>
</tbody>
</table>