Explore the Knowledge Integration in Knowledge Teams from a Transactive Memory Perspective

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Abstract

Knowledge has become the most important source of competition in the knowledge era. Organizations establish knowledge teams with knowledge workers who have different specialties to accomplish specific tasks. Knowledge integration combines individual knowledge to achieve synergy and is important to knowledge teams. This study adopts a transactive memory perspective to understand if knowledge integration can result in better performance. Questionnaires were e-mail to knowledge team members in organizations. The results indicate that the transactive memory system is positive related to knowledge integration and further affects team performance, both output performance and process performance. In addition, the concept of transactive memory systems contains three constructs. Specialization and credibility are positive related with coordination. Implications are further discussed.

1. Introduction

In the new age, knowledge has substituted for labor and technology and has become the key player in organizations [33]. Consequently, knowledge management is getting more attention from both practitioners and academic scholars. Organizational knowledge management consists of three overlapping processes—knowledge creation, codification, and application [4], all of which are related to organizational performance [2, 15, 29]. Knowledge application is that stage that utilizes knowledge held to solve problems. It is also the stage where the value of knowledge is created [4]. Knowledge integration is one of the key facets of knowledge application [3, 7, 30]. Although knowledge, especially the tacit know-how, is held by individuals [4, 33], integrating their knowledge into collective knowledge is important to organizations and work teams [28, 34]. From the resource-based perspective, knowledge is a critical resource for gaining competitive advantage. Knowledge integration is a way to utilize knowledge [3, 7, 30]. According to the theory of knowledge, knowledge integration is the core competency of an organization. The key is to utilize expertise that is spread within the enterprise by integrating knowledge [15, 32].

A team is an important mechanism that can recombine knowledge from different individuals to build collective knowledge [10]. Such a recombination would cover expertise in different domain, abilities, and resources that one person cannot have [11, 12]. An organization’s operations depend on teams much more than before, and a team has become the basic unit for problem solving and decision making [35]. Team performance does not depend on the ability of individuals, but on the ability to integrate all the information and knowledge that can be obtained [31].

In order to enhance team performance, team members should build consensus on all team members’ expertise and ability. Consequently, they can find and retrieve necessary knowledge easily. Previous studies have indicated that when team members are aware about each other’s expertise, they can utilize and integrate knowledge to solve problems and complete tasks more effectively [4]. Transactive memory system is one of the mechanisms that can help individuals recognize others’ expertise and ability. Accordingly, team members can rely on each other’s expertise to complete a task. In this way, each member can focus on a specific domain while ensuring that the necessary knowledge for the task is held in the team [20]. However, few studies discuss knowledge integration by the means of the transactive memory system perspective [1, 4, 19]. In order to fill this gap, the present study focuses on knowledge teams in organizations. The tasks of these teams are...
knowledge-intensive, such as system development, new product development, research and development (R&D) and consulting services. This study explores the predictors and effects of knowledge integration for knowledge teams from the perspective of transactive memory system and attempts to answer the following two research questions:

1. Does transactive memory system facilitate knowledge integration in knowledge teams?
2. Is knowledge integration related to knowledge teams’ performance?

2. Conceptual background and hypothesis development

Figure 1 shows the conceptual framework of this study.

![Figure 1. Research model](image)

2.1. Transactive memory system

The concept of transactive memory was first proposed by Wegner in 1987 [37]. It is applied in duality relations. Because an individual’s cognitive ability is limited, another person’s memory is viewed as one’s external auxiliary memory to release one’s burden of memory [25]. As this concept is used in a team, it means team members do not need to learn something the others have known. Because a team’s transactive memory is a function of each team member’s transactive memory, it is called the transactive memory system [20].

The word “transactive” implies that the development of such a system needs a lot of interaction and observation for a period [4, 5]. Moreland (1999) indicated that understanding others’ knowledge has three dimensions: accuracy, agreement (the same cognition among team members), and complexity (the level of expertise and detail of team members’ knowledge) [26]. Austin (2003) conceptualized transactive memory system into four dimensions: group knowledge stock, consensus about knowledge sources, specialization of expertise, and accuracy of knowledge identification [6]. According to this definition, transactive memory system is built in teams with several types of domain knowledge. Team members can allocate and utilize all of the knowledge correctly. In other words, transactive memory system includes all team members’ transactive memory and their cognition of others’ expertise [20]. It also implies that team members can retrieve knowledge from others [37, 38]. As a result, team members can release cognitive loading, utilize a wider range of knowledge, and avoid the duplication of effort to access the same knowledge [17].

Prior studies have indicated that when team members know what expertise the others hold; team performance improves [23, 24]. In addition, team members can integrate dispersed tacit knowledge using transactive memory system [4]. Overall, building transactive memory system enables teams to produce higher-quality outcomes effectively. Such an improvement can show a team’s productivity and capabilities and will increase cohesiveness among team members [6].

Lewis (2003) developed a transactive memory system measurement [20] that divides transactive memory system into three related dimensions: specialization (the cognition of the specialization of the other team members), credibility (the cognition of the credibility of the other team members), and coordination (the degree of coordination among team members). Indeed, these dimensions include the structure of a transactive memory system and the utilization process. Specialization means the understanding of members’ expertise. According to such an understanding, team members can develop complementary knowledge. Credibility represents the trust in others’ knowledge. Only when trust exists can one develop knowledge that no one owns. Finally, coordination is the process by which the team members utilize the knowledge held by other team members. Without effective coordination, the benefits of the transactive memory system will not be realized. In addition, complementary and reliable knowledge makes coordination possible and helpful. Accessing the knowledge held by others and the trust in and identity with team members’ expertise are contribute to effective coordination [22]. As a result, we conduct our first two hypotheses as follows:

\[ H1: \] Specialization is positively related to coordination.

\[ H2: \] Credibility is positively related to coordination.

2.2. Knowledge integration

Alavi et al. (2002) defined knowledge integration as the synthesis of individual expertise into collective knowledge that satisfies specific circumstances [4]. Robert et al. (2008) viewed knowledge integration as the recombination of information and expertise through social interaction among team members [31]. Grant
(1996) defined knowledge integration as a capability of organizations [14]. Knowledge integration enables an organization to engage in productive work and transform input to output effectively. It can create value directly or indirectly. Because knowledge is held by individuals, especially tacit know-how (Alavi et al., 2002), organizations and teams should try to integrate individual knowledge into collective knowledge [28, 34].

Knowledge integration is built on the basis of good relations between team members to enable them to share, utilize, and coordinate knowledge [31]. Good understanding among team members is the facilitator of knowledge integration [4]. As team members know how the work is completed, they will know when and how knowledge has to be accumulated [28]. Team members will work closely and this will make knowledge integration easier [20]. Therefore, the next three hypotheses are:

H3: Specialization is positively related to knowledge integration.

H4: Credibility is positively related to knowledge integration.

H5: Coordination is positively related to knowledge integration.

2.3. Team performance

Team performance includes several dimensions. Hoegl and Gemuenden (2001) defined it as the degree to which a team can satisfy the expectations of quality, cost, and schedule [16]. From this perspective, team performance can be judged from effectiveness and efficiency. Effectiveness represents the degree to which a team’s output quality can meet expectations. It focuses on the outcome. Efficiency means the degree to which a team completes its task within the schedule and budget. Its emphasis is on the process to fulfill a task [29]. Wallace and Rai (2004) called them as outcome performance and process performance [36].

When a team can integrate dispersed knowledge effectively, it forms a strong coordination system to perform its task [4]. Besides, knowledge available in the team decides how team members interpret information [9]. Knowledge integration provides a broader knowledge base for the team and intensifies the understanding of information [4]. Finally, when knowledge in a team is shared and integrated, team members will know how to adjust their work to cooperate with others and note external opportunities and threats [4]. The team’s performance will be improved [28]. This brings us to the sixth and seventh hypotheses of this study:

H6: Knowledge integration is positively related to a team’s outcome performance.

H7: Knowledge integration is positively related to a team’s process performance.

3. Methodology

3.1. Research design and sample

A cross-sectional survey was conducted through e-mail. Convenience and snowball sampling techniques were used. The respondents were asked to fill a questionnaire with reference to a project that had been completed in the previous 6 months. All constructs were drawn from prevalidated measures used in previous related studies and modified to suit our context. To measure the “transactive memory system”, we adopted the 15-item scale developed by Lewis (2003) [20], which contains three subscales—specialization, credibility, and coordination—each containing 5 items. Further, we adopted 4 items to measure “knowledge integration” from Tiwana and McLean (2005) [34], and 15 items to measure “team performance” from Hoegl and Gemuenden (2001) [16]. Because we attempt to investigate the predictors and effects of knowledge integration, the respondents were members of knowledge teams. In order to increase the response rate and sample size, one team member was considered as representative of an entire team [1, 18]. We received 255 questionnaires, out of which 215 were valid. The effective response rate is thus 84%. One-third of the respondents were female. The majority of the respondents were aged 26–34 years, and their tenure in the organization ranged from 1 to 6 years. This distribution is consistent with that in prior studies. Respondents were from the information systems (IS) department (48.84%), R&D (27.91%), and marketing (6.98%), as well as consultants (2.33%) and others (13.4%). They were asked to fill the questionnaire based on one of the projects completed recently—49.30% of them were information system development projects and 26.76% were information system implementation projects.

3.2. Measurement reliability and validity

All constructs were measured using multiple-item scales, and, wherever possible, measurement items were adapted from relevant literature. In addition, items associated with these constructs employed a seven-point Likert type scale, which ranged from “strongly disagree” to “strongly agree,” with its midpoint anchored as “neither agree nor disagree.”

Several domain experts were asked to assist in the translation and modification of the instrument in order to ensure content validity. After compiling the questionnaire, semantic differences were checked to
ensure that the wording of the instrument is consistent with the original version of the questionnaire. Moreover, a pilot test was conducted by two executives with 10 years’ work experience to ensure the face validity of our questionnaire. This was done to ensure that the wordings could be understood by the target audience.

Data analysis was conducted in two steps. First, the measurement model was analyzed using the confirmatory factor analysis (CFA) approach in order to evaluate the validity of the measurement. The partial least squares (PLS) method was then used to analyze the significance of the hypotheses with bootstrap resampling. PLS was selected because of the relative small sample and both outcome performance and process performance are formative [8].

First, the results of the CFA were used to ensure the construct reliability and validity. After excluding four items with high cross-loadings, the remaining items were found to have factor loadings higher than 0.5. The result was consistent with Fornell and Larcker’s suggestion [13]. Further, we computed the average variance extracted (AVE) for each variable. All the values obtained were higher than 0.5, indicating that the measurement had sufficient convergent validity [13]. Discriminant validity was assessed by the root of AVE. The result showed that the correlation coefficients of all the variables were smaller than the root of AVE, which indicates sufficiently good discriminant validity.

The reliability of the scales was assessed using Cronbach’s alpha and composite reliability. Nunnally (1978) suggested that if Cronbach’s alpha is larger than 0.7 and the composite reliability is larger than 0.8, the variable has sufficiently good reliability [27]. In our study, all indicators met the standards. The result implied that our measurement had good reliability and high internal consistency. Table 1 and Table 2 show the related indicators in this study. Because outcome and process performance are formative constructs, they are excluded from the calculation.

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<thead>
<tr>
<th>Table 1. CR, AVE &amp; Cronbach’s α</th>
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<td>AVE</td>
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<td>Creditability</td>
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<td>Coordination</td>
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<td>Knowledge Integration</td>
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<td>Performance</td>
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<th>Table 2. Correlations matrix</th>
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(Diagonal with grey shading is the root of AVE
SP: Specificity; CR: Creditability; CO: Coordination; KI: Knowledge integration; PE: Performance)

3.3. Testing of the hypothesized model

We used SmartPLS 2.0 to conduct a PLS regression for analyzing the research model. The result is shown in Figure 2. The main effects were tested to assess path coefficients and R-squared. The results of PLS showed that all the hypotheses are supported; 33% of the variance of “Coordination”, 57% of the variance of “Knowledge Integration”, 43% of the variance of “Output Performance”, and 34% of the variance of “Process Performance” are explained. Table 3 summarizes the result of path analysis.

<table>
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<th>Table 3. Results of hypothesis testing</th>
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<td>Hypotheses</td>
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<td>H1: SP-&gt;CO</td>
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<td>H2: CR-&gt;CO</td>
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<td>H3: SP-&gt;KI</td>
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<td>H4: CR-&gt;KI</td>
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<td>H5: CO-&gt;KI</td>
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<td>H6: KI-&gt;OP</td>
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<td>H7: KI-&gt;PP</td>
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* indicates 0.05 significance level; ** indicates 0.01 significance level.

R² for Coordination = 33.3%,
R² for Knowledge Integration = 56.8%,
R² for Output Performance = 42.6%,
R² for Process Performance = 33.9%,
SP: Specialization; CO: Coordination; CR: Credibility;
KI: Knowledge Integration; OP: Output Performance;
PP: Process Performance
4. Discussion and conclusion

4.1. Findings

All hypotheses are supported at the 0.05 significance level. The transactive memory system provides a proper perspective for understanding interactions among team members. Knowledge integration is highly related with project performance positively. It means that knowledge integration is a critical predictor of knowledge team performance. Most prior researches focus on knowledge sharing and knowledge transfer. We indicate that knowledge integration is equally important.

All three constructs of the transactive memory system are positively related to knowledge integration. The indirect effects of specialization and credibility are also verified. Lewis (2003) divided the transactive memory system into three dimensions [20]. This study further confirmed the relationships among these dimensions.

4.2. Implications

This study explores the predictors and effects of knowledge integration in knowledge teams from the perspective of the transactive memory systems. The results indicate knowledge integration do improve team performance both on outcome and process. Prior studies emphasized that knowledge integration contributes to knowledge innovation. They believed the value of knowledge integration arises from a synthesis of different domain of knowledge. This study explores the effects of knowledge integration on general knowledge teams. We clarify the benefits are common in knowledge teams. Knowledge integration makes the cooperation of team members more effectiveness and efficient.

Forming teams with members of different background and diverse professions has become common practice. Thus, integrating the knowledge of individual members to produce synergy is important to knowledge teams. From the perspective of the transactive memory systems, specialization, credibility, and coordination can enhance the integration of knowledge. Therefore, team leaders should try to promote understanding, trust, and cooperation among team members. The expected outcome from the team can then be achieved.

Specialization and credibility have positive effects on coordination and are, in fact, the very foundations of good coordination. Organizations expect team members to build a consensus as soon as possible. Then, teams can achieve the desired results. A common observation made in recent times is that team members usually have heterogeneous characteristics. This composition can increase the diversity of expertise and opinions. However, it also makes communication more difficult. Utilizing IT to help team members locate expertise they need and enhance mutual trust is important, especially when teams are composed of members with experience in cooperative structures but do not know each other well.

4.3. Limitations and future research direction

First, this study is conducted using a convenient sampling approach. Half the number of respondents are from the IS departments; and execute an IS-related project. Therefore, the generalizability of this study is limited. Broadening the sample targets would be helpful. Second, not all the respondents are project leaders. Perhaps they cannot access the information about some questions about the project performance. This make their evaluation of project performance may not be objective. In future studies, different sources could be involved to avoid cognition bias. Third, teams are smaller social systems in organizations. Therefore, the operation of teams will be affected by some organizational contexts, such as culture. Conducting a hierarchical analysis to include organizational factors is another possible direction. Finally, respondents were asked to recall a project that was completed recently. However, most respondents were involved in several projects at a time and may have been confused about the answers. Therefore, a longitudinal study should be employed to reduce memory-related problems.

5. References