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TRANSACTIVE MEMORY SYSTEM IMPACT ON TEAM PERFORMANCE THROUGH KNOWLEDGE QUALITY AND PERCEIVED KNOWLEDGE SATISFACTION

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Abstract

Knowledge management is deemed as an effective way to maintain organization competitive advantage. However, researchers and practitioners began to question function of knowledge management on performance and try to measure knowledge management performance more precisely. To better understand the relationship between knowledge management and performance, we combine transactive memory systems with knowledge management performance to investigate their impact on team performance based on an integrative research framework for studying knowledge management. We conducted survey in knowledge worker teams in several cities in Mainland China. Results indicate that transactive memory systems have a positive impact on team performance through knowledge management performance. Theoretical and practical implications are discussed.

Keywords: Transactive memory systems, knowledge quality, perceived knowledge satisfaction

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1 INTRODUCTION

Knowledge Management initiatives have been initiated in organisations over the last 20+ years, but in many instances, the initiatives have failed to yield an expected return on investment (Garud and Kumaraswamy, 2005). This had lead both organisations and researchers to question the value of these initiatives and to try and measure knowledge management performance more precisely, including such measures as knowledge quality and the extent to which knowledge management performance can enhance team performance. At the same time, researchers also proposed that the linkage between knowledge management and organisation performance was very obscure and difficult to investigate because of complicated organisational environmental circumstances (Bharadwaj, 2000).

To better understand the relationship between knowledge management and organisational performance, Lee and Choi (2003) proposed an integrative research model for studying knowledge management (see Figure 1). In their research, they suggested that there are intermediate outcomes between knowledge management processes and organisational performance. They also indicated that compared to knowledge management processes, intermediate outcomes that stem from management processes can better predict organisational performance.

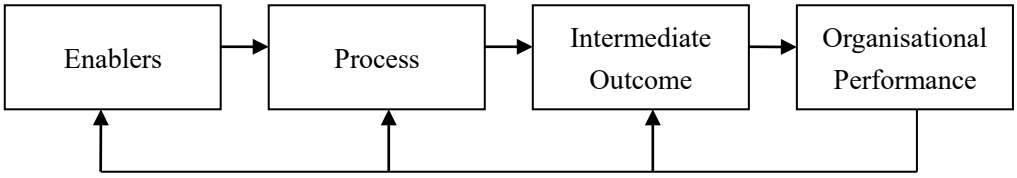

Figure 1. An Integrative Research Framework for Studying Knowledge Management (Lee and Choi, 2003)

Yu, Kim and Kim (2007) propose that perceived knowledge satisfaction and knowledge quality are two critical factors of knowledge management performance which have an impact on team performance. They further choose driving factors from a resource-based view: learning orientation, knowledge management reward, knowledge sharing intention and knowledge management system quality. Fernandez and Sabherwal (2001) confirmed the importance of perceived knowledge satisfaction in knowledge management research and its effect on team performance. They also suggest in their theoretical framework that knowledge management processes will positively affect perceived knowledge satisfaction.

Transactive memory systems have been widely studied in knowledge management research and practice. It has been well established that transactive memory systems can improve team performance by enabling team members to access expertise in a more efficient way and by increasing the effectiveness of the whole collaboration process (Lewis, 2004). Wegner (1986) indicates that transactive memory systems in a team not only involve the processes of communication between team members, but also embrace the processes of encoding, storage and retrieval. Hence, as

an integration of knowledge management processes, a transactive memory system might also help to produce intermediate outcomes so as to enhance team performance.

In this research, we followed Lee and Choi's (2003) theoretical framework, investigating transactive memory systems' impact on team performance, mediated by perceived knowledge satisfaction and knowledge quality. We suggest that a transactive memory system can facilitate perceived knowledge satisfaction and knowledge quality, at the same time contributing to team performance.

2 LITERATURE REVIEW

2.1 Transactive Memory System

Transactive memory refers to the condition that "one person has access to information in another's memory by virtue of knowing that the other person is a location for an item with a certain label" (Wegner, 1986, p189). In this way, people can enhance their own memory stores by communicating with each other. Thus, transactive memory at a team level enables each team member to easily locate the person who has the needed knowledge and obtain the knowledge through communication.

Transactive memory systems refer to "a specialized division of labor that develops within a team with respect to the encoding, storage, and retrieval of knowledge from different domains" (Kanawattanachai and Yoo, 2007). Definitions of transactive memory generally contain two perspectives: one is the combination of personal knowledge and the other is the awareness of who knows what within the team (Wegner, 1986). However, scholars have been inclined to focus on the second part of the definition (Cruz, Perez and Ramos, 2007). A team supported by transactive memory systems will recognize, trust and coordinate specialized knowledge among team members. Previous research indicates that transactive memory systems development will have a positive impact on team performance (Hollingshead, 2000). Argote, McEvily and Reagans (2003) also contend that transactive memory systems facilitate knowledge management activities in such domains as creativity, retention and transfer of knowledge. Hence, considering transactive memory as a contributor to knowledge management processes, we investigate to what extent transactive memory systems and knowledge management performance (i.e. knowledge quality and perceived knowledge satisfaction) exert an impact on team performance.

Transactive memory systems have been deemed to have several dimensions. Moreland (2006) indicates three dimensions: accuracy, agreement and complexity. Austin identifies four dimensions: stock of knowledge, consensus about knowledge sources, specialization of the experience and accuracy. The mostly accepted dimensions are proposed by Lewis (2004). The dimensions and definition are:

Specialization: The differentiated structure of member knowledge.
Credibility: Members' beliefs about the accuracy and reliability of other members' knowledge.
Coordination: Effective and orchestrated knowledge processing.

A positive relationship between transactive memory systems and team performance has been confirmed in previous research (Lewis, 2004; Kanawattanachai and Yoo, 2007; Zhang, Hempel, Han and Tjosvold, 2007). Austin (2003) found that the positive relationship between transactive memory systems and team performance not only exists in single project teams but also in mature and continuing teams. Some researchers also investigated the impacts of different transactive memory systems dimensions' on team performance. Kanawattanachai and Yoo (2007) conducted a longitudinal study and found that the dimension of task-knowledge coordination is a key construct which influences team performance because task-knowledge coordination can mediate the impact of the other two dimensions.

2.2 Knowledge Quality and Perceived Knowledge Satisfaction

Yu et al. (2007) employed knowledge quality and user knowledge satisfaction as two critical dimensions of knowledge management performance. They further conducted a survey in Korean organisations and found that learning orientation, knowledge management reward, and knowledge management system quality positively influence knowledge management performance. Specifically, learning orientation and knowledge management reward have a positive impact on knowledge quality; knowledge management system quality and knowledge management reward has a positive impact on user knowledge satisfaction. However, in their research, they ignore the interaction perspective during knowledge management processes.

Knowledge satisfaction has also been mentioned by Lee and Choi (2003). In their research, they contend that there should be an intermediate outcome between knowledge management process and organisational performance. Further, they suggest that knowledge satisfaction can be an intermediate outcome. Fernandez and Sabherwal (2001) combine the SECI knowledge management process proposed by Nonaka and Konno (1998) into research on knowledge effectiveness. Fernandez and Sabherwal (2001) also employ perceived knowledge satisfaction to measure knowledge effectiveness. In their research, both qualitative and quantitative studies have been conducted and they found that combination and externalization contribute to knowledge satisfaction. They further propose that the two processes that generate explicit knowledge were also found to have a positive impact on perceived knowledge satisfaction. However, this result contradicts previous findings (Dhanaraj, Lyles, Steensma and Tihanyi, 2004) which suggest that tacit knowledge would be more valuable and effective than explicit knowledge, and thus should have a stronger impact on satisfaction.

Past research on knowledge quality mostly concentrated on a systems design perspective. Clay, Dennis and Ko (2005) propose that knowledge quality is one of the key drivers which influences perceived usefulness of knowledge management systems; a more useful KMS is more likely to be used continuously. Knowledge quality was also found to increase the frequency of knowledge transfer between teams (Kane, Argote and Levine, 2005). Chen (2007) also proposed that knowledge quality will lead to website use satisfaction.

3 RESEARCH MODEL AND HYPOTHESES

According to the literature review, we developed our research model shown in Figure 2. This model posits that transactive management systems can enhance intermediate outcomes including knowledge quality and perceived knowledge satisfaction, which finally lead to higher team performance. The following section will elaborate on our research hypotheses.

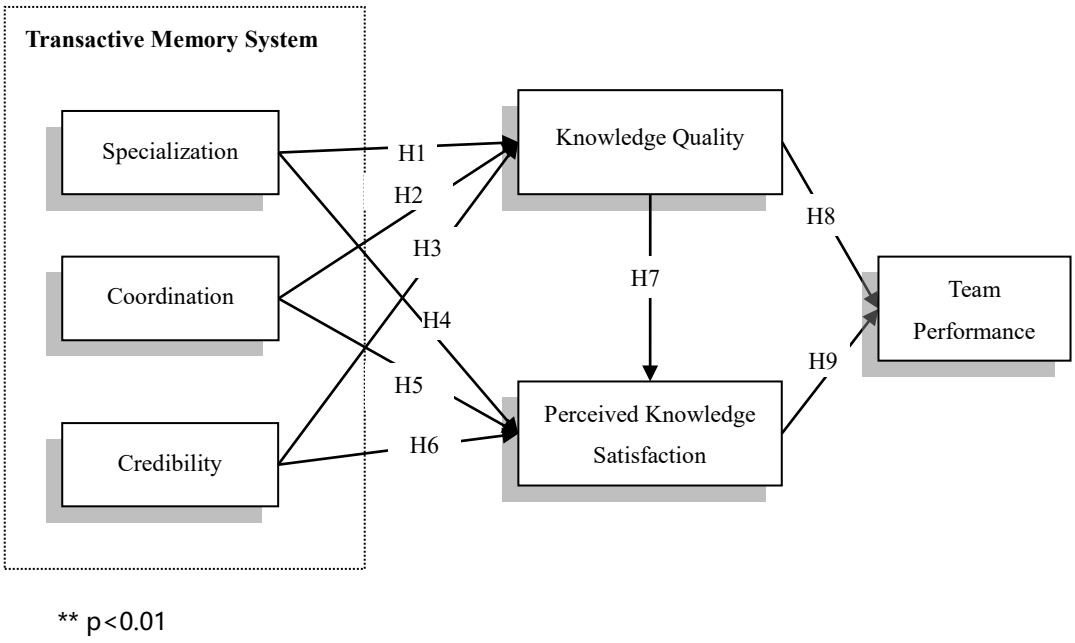

Figure 2. Research Model

Specialization refers to the differentiated structure of member knowledge (Lewis, 2004). In an organization, the increasingly compartmentalized structure of teams will make team members focus more on their own areas of expertise. In this context, each team member will be more specialised and so more likely to offer other members high quality knowledge. Grant (1996, p112) indicates that "experts are (almost) invariably specialists while jacks-of-all-trades are masters-of-none".

H1 Specialization positively affects knowledge quality.

However, during the knowledge transfer process, significant information might be lost due to the character of knowledge. For example, Pfeffer and Sutton (1999) contend that the intangible part of tacit knowledge cannot be transferred through

structured processes. Oshri, van Fenema and Kotlarsky (2008) demonstrate that effective knowledge transfer happens under several conditions including shared language and basic background knowledge. Hence, high quality knowledge can be transferred during the coordination process as members will get acquainted with each other and have a better understanding of what they need and what they already have during the coordination process. Through discussion and coordination, it is more likely that high quality knowledge can be sought and shared.

H2 Coordination positively affects knowledge quality.

Finally, previous research also indicates that although team members are willing to share, not all the shared knowledge is actually useful. Lack of trust in the knowledge sharer is one of the important reasons for this non-use. Cognition based trust has been found to have a significant impact on knowledge transfer. Holste and Fields (2005) suggest that cognition based trust will lead a person to use the knowledge, which indicates that employees will cherish the knowledge obtained from credible persons.

H3 Credibility positively affects knowledge quality.

Satisfaction can be achieved when persons' certain need has been fulfilled (Miller and Monge, 1986). According to this logic, perceived knowledge satisfaction could be enhanced when people find the knowledge they need and find it useful during the work. Wegner (1986) contend that a team supported by an effective transactive memory system can satisfy the team members by reaching their goals effectively.

Specialization, as we argued before, could let team members be more engaged in their own area of expertise so that they could offer their team members useful and specialised knowledge. Besides, clear specialization can help team members locate the target knowledge within the team so that they can contact the person in an efficient way and obtain the knowledge they need (Hollingshead, 2000).

H4 Specialization positively affects perceived knowledge satisfaction.

Previous research indicates that for better knowledge coordination, team members should not only know how to find the knowledge, but also should understand how tasks are divided, how subtasks are correlated, and how subtasks are assigned to different team members (Cannon-Bowers and Salas, 2001; Kanawattanachai and Yoo, 2007). Grant (1996) further proposes that coordination should demand that each team member integrates their own function to the whole task performance. Hence, team members should realize how to share knowledge in an efficient way so as to avoid misunderstandings caused by being from different professional areas. Prior research indicates that members with different professions and departments frequently encounter communication confusion because of their different education and working experiences (Reagans and McEvily, 2003). Through coordination, team members should share and obtain knowledge in a coordinated way so as to enhance members' knowledge satisfaction.

H5 Coordination positively affects perceived knowledge satisfaction.

Ko, Kirsch and King (2005) indicate that credibility enhances the whole efficiency of the knowledge transfer process. Previous research suggests that perceived usefulness of knowledge is positively related to the credibility of the source (Mizerski, Golden and Kernan, 1979). Szulanski, Cappetta and Jensen (2004) also contend that recipients would be more open and receptive when the source of the knowledge is credible. In this way, members who have a high level of credibility would be more likely to be trusted by knowledge seekers, enhancing their perceived knowledge satisfaction.

H6 Credibility positively affects perceived knowledge satisfaction.

High quality knowledge will be more useful for working processes and will enhance team members' perceived knowledge satisfaction. Yu et al. (2007) demonstrate that knowledge quality will have a positive impact on user knowledge satisfaction. Hence, we argue that team members acquiring high quality knowledge will be more inclined to recognize and be satisfied with that knowledge and knowledge management environment in organizations.

H7 Knowledge quality positively affects perceived knowledge satisfaction.

Both knowledge quality and knowledge satisfaction have been regarded as critical determinants of knowledge performance and were considered to have a significant impact on team performance (Yu et al., 2007), because knowledge management performance has been found to lead to better team performance (Nonaka, 1994). In addition, intermediate outcomes of knowledge management (knowledge quality and perceived knowledge satisfaction) will lead to higher levels of organisational performance (Lee and Choi, 2003). In this study, we focus on transactive memory systems within teams. Hence, we hypothesize that,

H8 Knowledge quality positively affects team performance.
H9 Perceived knowledge satisfaction positively affects team performance.

4 RESEARCH METHODOLOGY

The survey method was adopted to test our hypotheses. We examined knowledge worker teams because, as Lewis (2004) argued, the effect of transactive memory systems should be obvious in those teams in which "outputs and performance rest on members' knowledge and expertise". Hence, we first identified organisations where employees engage in knowledge work and are structured in teams. These organisations are located at many cities in China. We contacted a total of 43 companies, with 36 agreeing to participate in the research. We introduced the research topic to all potential respondents and gave them assurances that all the data would be kept confidential. In total, we received 309 responses from employees working in 72 teams.

In order to ensure a clean data set, we eliminated teams if questionnaires were incompletely filled out, or where fewer than 3 completed questionnaires were received. Our final data set consisted of 294 individuals from 69 teams in 34 companies. The number of respondents in a team ranges from 3 to 16. The demographic characteristics of these 294 respondents are presented in Table 1.

Table 1. Demographic Information

Measures	Items	Frequency	Percent	Measures	Items	Frequency	Percent
Gender	Male	184	62.6%	Age range	18-25	134	45.6%
	Female	110	37.4%		26–35	128	43.5%
					36–45	27	9.2%
					46 and above	5	1.7%
Education	Primary/			Position	Non-Management		
level	secondary				Employee	239	81.3%
	school	4	1.4%		Manager	49	16.7%
	College	58	19.7%		Senior or Executive	6	2.0%
	Undergraduate	200	68.0%		Manager		
	Master or above	32	10.9%				
Industry	Manufacturing	12	17.4%	Team	Zhengzhou (N)§	8	11.6%
Type of the	IT industry	29	42.0%	Location	Shenzhen (S)	6	8.7%
teams	Education	4	5.8%		Fuzhou (E)	8	11.6%
	Construction	9	13.0%		Haikou (S)	4	5.8%
	Finance and				Beijing (N)	8	11.6%
	Banking	8	11.6%		Shanghai (E)	11	15.9%
	Logistics and				Qingdao (E)	9	13.0%
	Transportation	5	7.2%		Chengdu (W)	9	13.0%
	Others	2	2.9%		Wuhan (C)	6	8.7%
Number of	50 or below	14	4.8%	Team	10 or below	26	36.7%
Employees	51-100	94	32.0%	size	11- 20	30	43.5%
	101-500	68	23.1%		20-30	11	15.9%
	501-1000	53	18.0%		31or above	2	2.9%
	1001 or above	65	22.1%				

Note: N = North; S = South; E = East; W = West; C = Central

To test the potential non-response bias, we adopted the method Armstrong and Overton (1977) suggested. We compared the Chi-squares of the key measures of the responses from the first 25% of the respondents and those of the final 25%.The results showed that there were no significant differences between these two groups on these items. This indicates that non-response bias was not serious in this study.

In this study, we collected all perceptual data from a single source at one point in time. Such research designs are prone to common method bias. To assess common method bias, we thus used Harmon's one-factor test (Carr, 2007). The analysis results showed that all used items created six constructs with eigenvalues greater than 1.0, accounting for 70.25% of the variance; the first construct explained 24.71% of the

variance. Thus, common method bias was not a serious concern for this study (ibid.).

Following Churchill's (1979) suggestions, all of the survey items were adapted from the previous literature, with some of the items customised to fit our research context more appropriately. All items in the survey were measured using seven-point scales anchored from "strongly disagree" to "strongly agree". All the items and sources of the items are presented in Appendix A. In order to ensure the content validity, five PhD students who majored in Information Systems were invited to review the measurement items. Because the survey was to be conducted in Mainland China, all the instrument items have been translated into Chinese using a translation committee approach.

5 RESULTS

5.1 Measurement model

We first tested measurement validity via confirmatory factor analysis (CFA), and then employed LISREL to analyze our framework. Specifically, the results of CFA showed that the loadings of all items were greater than 0.70. Further, as shown in Table 2, Cronbach's alphas ranged from 0.73 to 0.95 and composite reliability ranged from 0.83 to 0.97, which were both above the recommended level of 0.60. Meanwhile, the value of Average Variance Extracted (AVE) ranged from 0.55 to 0.91, i.e. higher than 0.50 (Flynn, Sakakibara, Schroeder, Bates and Flynn, 1990). As such, the measurement has good convergent validity. Further, Table 3 showed that the square roots of AVEs for each construct are greater than the correlations between constructs, which indicates that the measurement achieved adequate discriminant validity.

In this study, we treated team performance as a second-order reflective construct. To assess whether all first-order dimensions, namely outcome satisfaction, team satisfaction, and outcome quality actually reflected team performance, we employed a second-order CFA using the three extracted agility dimensions. The results indicated that the higher order measurement model had a good model fit ($\chi 2$ =111 on 34 df, RMSEA=0.10, CFI=0.99, IFI=0.99, NFI=0.98, NNFI=0.98, GFI=0.92), with a possible exception of the RMSEA. Although the value of RMSEA was slightly above the suggested cut-off value of 0.08, it still met the criterion recommended by Hair et al. (1998) (i.e., RMSEA≤0.10). The results also showed that the loadings, ranging from 0.91 to 0.95, of each dimensions on team performance were positive and significant ($p<0.001$). Furthermore, their correlations were significant at $p<0.001$, indicating that they converged on the common underlying construct of supply chain agility (Bauer, Falk and Hammerschmidt, 2006).

Table 2. Results of confirmatory factor analysis

	Items	Cronbach's Alpha	Composite Reliability	AVE
Specialization	4	0.73	0.83	0.55
Coordination	4	0.79	0.87	0.62
Credibility	4	0.82	0.88	0.66
Knowledge quality	5	0.84	0.89	0.62
Perceived knowledge satisfaction	5	0.89	0.92	0.69
Second-order Team performance		0.92	0.95	0.87
Outcome Satisfaction	3	0.91	0.94	0.85
Team Satisfaction	3	0.92	0.95	0.87
Outcome Quality	3	0.95	0.97	0.91

Table 3. Mean, standard deviation, and correlation

	Mean	SD	1	2	3	4	5	6
1. Specialization	5.33	0.88	0.74					
2. Coordination	5.21	1.04	0.43	0.79				
3. Credibility	5.48	0.89	0.49	0.67	0.81			
4. Knowledge quality	5.26	0.95	0.35	0.50	0.59	0.79		
5. Perceived knowledge satisfaction	5.09	1.15	0.39	0.54	0.63	0.64	0.83	
6. Team performance	5.49	1.04	0.50	0.73	0.66	0.54	0.65	0.93

Note: Means are assessed based on average factor scores; standard deviations (SD) and correlations are from the second-order CFA output. The diagonal elements are the square root of the AVE.

5.2 Structural model

In Figure 3, we show the results of the structural model, which was tested using LISREL. The results showed a good fit between the model and the dataset ($\chi 2$ =642.88 on 218 df, RMSEA=0.079, CFI=0.97, IFI=0.97, NFI=0.95, NNFI=0.96). The results presented that most hypotheses were supported, except H1, H4, and H8. In particular, the results showed that coordination had positive effects on knowledge quality (β=0.26, $p<0.01$) and perceived knowledge satisfaction (β=0.29, $p<0.01$), as anticipated in H2 and H5. In addition, credibility was positively related to knowledge quality (β=0.49, $p<0.01$) and perceived knowledge satisfaction (β=0.25, $p<0.01$), supporting H3 and H6, respectively. Consistent with H7, knowledge quality had a significant influence on perceived knowledge satisfaction (β=0.35, $p<0.01$). Further, the results showed that the greater perceived knowledge satisfaction (β=0.21, $p<0.05$), the better team performance, thereby supporting H9.

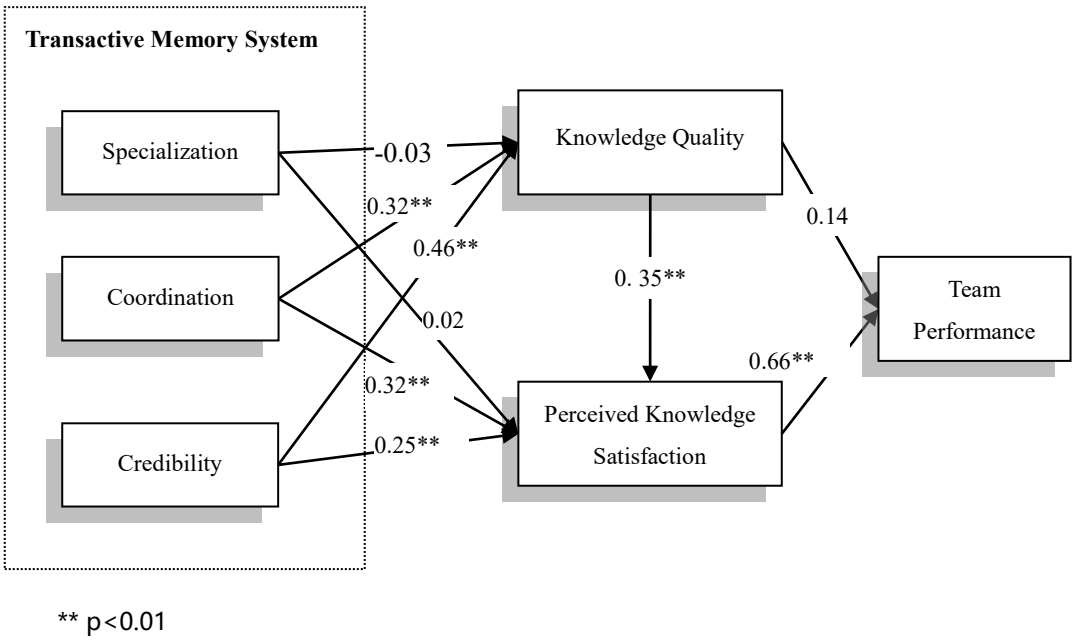

Figure 3. Structural Model and Results

6 DISCUSSION

In this study, we combine transactive memory systems with knowledge management performance to investigate their impact on team performance based on an integrative research framework for studying knowledge management proposed by Lee and Choi (2003). Following their framework and previous research, we choose to investigate transactive memory systems, knowledge quality and perceived knowledge satisfaction's impact on team performance. Most of the hypotheses are supported based on our research findings, which confirms that transactive memory systems' impact on team performance is established through increasing the quality of the knowledge and perceived satisfaction of the knowledge.

However, we did not find a significant relationship between specialization and either knowledge quality or perceived knowledge satisfaction. The possible explanations for the unsupported hypotheses can be that specialization can help people quickly locate the person from whom they can get their needed knowledge; however, it cannot ensure that those people with related knowledge will provide them with useful and satisfying knowledge. These situations may happen in situations characterised by people who come from different professional backgrounds or who do not have the skills to explicitly communicate their knowledge some types of knowledge may be very difficult to represent explicitly. This condition also explains why specialization does not significantly affect perceived knowledge satisfaction.

The results indicate that there is no significant relationship between knowledge quality and team performance, either. It might be that team members perceived the quality they obtained is high yet they cannot find it useful for work. This situation may be more likely to happen when team members are from different professional backgrounds (Reagans and McEvily, 2003).

Because of the insignificant relationship between knowledge quality and team performance, a mediation test was conducted. Results indicate that instead of the direct impact from knowledge quality to team performance as we expected, perceived knowledge satisfaction fully mediates the relationship between knowledge quality and team performance. This indicates that instead of a direct effect on team performance, knowledge quality can only influence team performance through increasing perceived knowledge satisfaction. The results also indicate that compared to knowledge quality, perceived knowledge satisfaction might be a better factor of intermediate outcomes to predict team performance in organisations.

7 LIMITATIONS AND FUTURE RESEARCH

There are some limitations to this research which future research could address. First, this study involved a cross-sectional design instead of investigating teamwork from a long-term perspective. Since transactive memory systems in a team need to be cultivated progressively, it would be valuable to conduct a long term research project to investigate how transactive memory systems form and how transactive memory systems at different levels of maturity may affect team performance through perceived knowledge satisfaction. A second limitation is that we only examined a few of the factors as intermediate outcomes of knowledge management from the knowledge perspective rather than the capability of the team. According to the resource-based view, team performance can also be formed through capability enhancement. In this way, future research can explore additional intermediate outcomes so as to enhance our understanding about knowledge management performance. Finally, the results are necessarily limited to Mainland China and so generalizability to other countries may not be assured.

8 IMPLICATIONS

Our research makes significant contributions to both research and practice. This study advances theoretical development in both the area of transactive memory systems and knowledge management by illustrate their combined impact on team performance. It contributes to a better understanding of how transactive memory systems can enhance team performance through knowledge management mechanisms. Moreover, compound results from transactive memory systems' effect on knowledge quality and perceived knowledge satisfaction suggest that it is necessary to investigate each dimension of transactive memory system separately rather than treating them as one single construct. Finally, previous research mainly focuses on knowledge management processes and objective outcomes while perceived knowledge satisfaction has been ignored. Our research proposes and confirms the important function of this concept, which leads to higher team performance, which can be extended in future research on knowledge management. According to this logic, when initiating knowledge management projects, managers should focus on employees' perceived knowledge satisfaction since the essence of knowledge management is to focus on

people and the way people think. Placing employees with different types of expertise into one team is unlikely to produce the desired results unless they can develop mutual credibility and coordinate their tasks effectively.

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Appendix A: Transactive memory system (Lewis, 2003)

Specialization

Each team member has specialized knowledge of some aspect of our project.
I have knowledge about an aspect of the project that no other team member has.
I know which team members have expertise in specific areas.
The specialized knowledge of several different team members was needed to complete the project deliverables.

Credibility

I was comfortable accepting procedural suggestions from other team members.
I trusted that other members' knowledge about the project was credible.
I was confident relying on the information that other team members brought to the discussion.
I did not have much faith in other members' "expertise." (reversed)

Coordination

Our team had very few misunderstandings about what to do.
Our team needed to backtrack and start over a lot. (reversed)
We accomplished the task smoothly and efficiently.
There was much confusion about how we would accomplish the task.

Knowledge quality (Chiu, Hsu and Wang, 2006)

The knowledge shared by members in our group is easy to understand.
The knowledge shared by members in our group is accurate.
The knowledge shared by members in our group is complete.
The knowledge shared by members in our group is reliable.
The knowledge shared by members in our group is timely.

User knowledge satisfaction (Fernandez and Sabherwal, 2001; Chou, Chang, Tsai and Cheng, 2005)

I am satisfied with the knowledge available for various tasks across our company.
I am satisfied with knowledge sharing among various directorates at our company.
The available knowledge improves our company's overall effectiveness.
I am satisfied with the management of knowledge at our company.
I am satisfied with the management of knowledge I need.

Team performance (Fuller, Hardin and Davison, 2007)

I am satisfied with the project outcome produced by my team.
I am pleased with the quality of work we did in my team.
I am satisfied with the final project deliverable submitted by my team.
I was satisfied with my group members.
I was pleased with the way my teammates and I worked together.
I was very satisfied working with this team.
The work produced by my team was high quality.
The project outcome produced by my team was excellent.
The deliverables of my team were outstanding.