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Can Instant Messaging Empower Teams at Work?

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Abstract — **Instant messaging (IM) has become increasingly prevalent as a communication tool of choice for social networking. However, application of IM at work remains controversial due to the inherent challenges associated with quantifying the benefits for organizations. In this study we integrate social network theory and transactive memory theory to examine IM's significance for organizations. We propose that IM has the potential to facilitate knowledge sharing by establishing relationship networks in the workplace, which sequentially enhance teamwork performance. This conceptual model is validated by 253 survey responses collected from employees of Chinese organizations. The data indicates that IM can empower teams at work via social networks and knowledge sharing. The theoretical and practical implications of the findings are discussed.**

Keywords - instant messaging, social network, knowledge sharing, teamwork performance

I. INTRODUCTION

Instant messaging (IM) is the one of the fastest-growing computer-mediated communication (CMC) technologies in our social life. IM's capability to provide instant connectivity and thus enable close to real time interaction in a cost-effective manner differentiates it from other CMC tools such as email, video conferencing and online communities. Although IM is widely used in socialization, its adoption in the work context remains controversial. This is largely due to the challenge of quantifying the benefits of IM for organizational performance if concerns about security issues and work disturbance are taken into consideration. Since 2001, Gartner Research has paid attention to IM's usage at work. Gartner researchers [1] called IM the "sleeping giant" of Internet applications in organizations due to its largely untapped and unrecognized benefits, calling for an in-depth investigation into IM's impacts on enterprises.

In academics, scholars have provided some empirical evidence of IM's influence at work. For example, Quan-Haase et al. [2] illustrated the use of IM for collaboration in a high-tech firm and Cho et al. [3] employed the technique of social network analysis to visualize the map of nodes and ties in work-related IM networks. These case-based studies have provided exploratory but rich insights into the power of IM. However, the latest available survey on IM use in the workplace undertaken by the AMAPI [4] indicates that only 35% of surveyed employees have utilized IM at work. This is corroborated by Gartner researcher Mann [5] who, in a follow-up study of social networking tools including IM, indicated that "the number of companies that see the value of social networking is small". The challenge of quantifying the value of social networking in organizations, where IM could be one of most dominant social networking tools, still remains at both the theoretical and empirical levels. This means *"what, and to what extent, can IM add value to the work context"* requires in-depth research.

Regardless of the technology advancement, teams are widely deployed at all levels in organizations and are also of theoretical interest of academics. Consequently, scholars have explored factors affecting team performance from various perspectives. Notably, Fuller et al. [6] provide both theoretical and empirical evidence for the impact of a virtual team's efficacy on teamwork performance. They offer a theoretical lens for the measurement of teamwork performance. While a critical process for teamwork, knowledge workers' information-sharing behaviour may be hindered by formal organizational structures, cf. [7]. IM, as an informal social tool offers a suitable platform for information sharing that can be used in peer-peer, superior-subordinate, and cross-department collaboration. However, its significance in facilitating teamwork is far from clear.

In order to address the above-mentioned challenges, we follow the logic of communication performance theories [8, 9] to examine the value of IM used at work. The theories of communication performance state the appropriate use of CMC tools can facilitate working partners' communication and sequentially the work performance. This logic founded a theoretical ground for this study to draw the path from IM to communication, and then treat work performance as the final outcome of measures. Regarding the communication process, we employ social network theory (SNT) and transactive memory theory (TMT), i.e., knowing who knows what and

accessing others' knowledge, to develop a conceptual model about the impact of IM for teamwork performance via communication. We argue that IM can function as a task-based CMC tool. IM enables a well-connected social network for actors, merging interpersonal and work relationships. Between network members, information, knowledge, and other resources are exchanged for effectively accomplishing team work.

We provide theoretical justifications for these arguments in the following section where we develop hypotheses. We then describe our research method, which is a survey of 253 working professionals. Following the data analysis, we summarize the findings and suggestions for future research. We conclude this paper with implications and contributions.

II. THEORETICAL DEVELOPMENT

In this section, we follow the logic of communication performance theories to establish the overarching arguments that the use of CMC tools can facilitate communication at work and then contributes to team performance. Specifically, we draw on SNT and TMT to articulate the empowering effects of IM for work teams. We propose that an IM can facilitate the formation of a social network between team members, providing an effective communication channel for sharing explicit and tacit knowledge. Meanwhile, an IM-enhanced social network plays a prominent role in encouraging knowledge sharing among team members. These both contribute to teamwork performance including team satisfaction, outcome satisfaction and outcome quality. We summarize the research model in Figure 1 and the construct definitions in Table I.

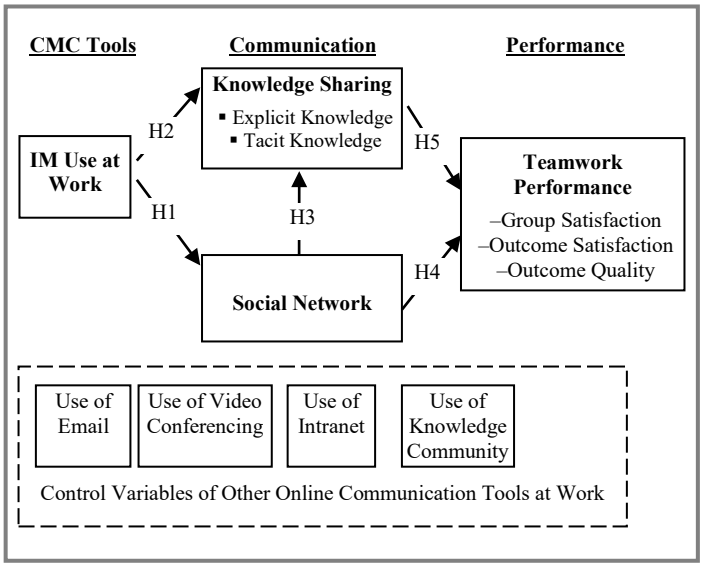

Figure 1. Proposed Research Model

A. The Effects of IM Use at Work

Over the past few decades, both practitioners and scholars have generated powerful insights on social networks. In 1950s, Barnes [12] started to use social networks to connote sets of complex relationships between members of social systems at all levels from interpersonal to international. SNT views social relationships in terms of nodes (i.e., actors in social networks) and ties (i.e., relationships between actors) [12, 13]. In China, the concept of a social network is synonymous with guanxi, which refers to close personal ties and social relationships [10]. Guanxi is envisaged as a process of social interaction that reciprocally and mutually connects network members [14]. In parallel with this conceptual connotation of a social network, social network analysis has been applied to the study of network maps. This technique enables the visualization of the importance of social networks in team structure and performance [15], and IT-based business process performance [16].

TABLE I. CONSTRUCT DEFINITIONS AND REFERENCES

Principle Constructs	Definitions	Reference
IM Use at Work	The employee's use of IM as a work-related contact and communication tool to ask questions, answer questions, share files and engage in work-related socialization	[2, 3]
Social Network	The degree of social contacts, relationships, ties and associations by making connections through individuals	[10, 11]
Knowledge Sharing	The degree to which one believes that one will engage in knowledge sharing act, including explicit and tacit knowledge	[7]
Teamwork Performance	The employees' perceptions of team satisfaction, team outcome satisfaction, and outcome quality	[6]

Functioning as a social networking tool, IM has been among the fastest-growing technologies used for the purpose of connecting people and maintaining interpersonal relationships [17]. Developing appropriate IT tools for facilitating CMC has long been one of the research focuses in the discipline of information systems (IS). As a prominent CMC tool, IM can spawn an instant reaction via a message dialogue window, forming a two-way near-synchronous form of communication that is lifelike and close to the transparency associated with traditional face-to-face interaction. Such instant interaction is inherently beneficial for distributed team work in terms of crossing geographical and temporal boundaries so as to form the interpersonal and work relationship. The development of a relationship network no longer needs to rely heavily on physical contacts, but instead can rely on online instant connections. During the IM interaction process, team members can clearly negotiate work expectations and explore social contexts [3], and thus reduce the uncertainty and tension in a work relationship. Such a spontaneous and informal communication style has been considered more effective in forming working relationships than scheduled and formal interactions [3, 18]. Accordingly we hypothesize that

Hypothesis 1: The use of IM at work enhances the social network in the workplace.

Despite the general perception that IM use at work is purely social, studies have found that IM can be used for business purposes, such as for solving mutual knowledge problems [19]

and for collaborative activities [20]. In this sense, IM is not only an effective social networking tool, but also a valuable channel for sharing, transferring and documenting knowledge. By using IM at work, collaborators can build up their common knowledge by quickly exchanging documents, referring to the transcripts, and correcting misunderstandings of intended meanings as they interact [3]. Furthermore, as suggested by research on IS used in Chinese organizations, informal IT tools appear more suitable for managing information in China due to China's high-context environment, cf., [21], further evidenced by failure cases of formal KM systems in Chinese organizations [22]. In a high context of social and work environment, IM can be used effectively for knowledge sharing because of the turn-taking, rapid, informal interactions that mimic face-to-face conversations. However, the "quasi-synchronous" character of IM also allows carefully written formal sentences. IM is a communication tool that can be used both for complex work collaborations and for simple task coordination. Its informal and casual characteristics make it useful for team-based knowledge sharing. Accordingly we hypothesize that

Hypothesis 2: The use of IM at work facilitates knowledge sharing in the workplace.

B. The Effects of Social Networks

The sharing of explicit and implicit knowledge has become a competitive necessity in organizations [7]. Past studies have provided fruitful insights on the motivation to share knowledge. Instead of commonly studied factors such as organizational climate, extrinsic reward and psychological factors, the relationship network can function as an important mediator between the use of IM and knowledge sharing. IM not only enables a channel for knowledge sharing, but more importantly makes it possible to facilitate a relationship network by connecting collaboration partners. This in turn influences individual attitudes and knowledge sharing behaviours because good relationships can result in favourable actions including receiving explicit and tacit knowledge from other actors in the network. Knowledge sharing is a reciprocal process, especially in cooperative situations [7, 23]. Organizational members who have built extensive relationships are expected to share their knowledge due to the social expectation of reciprocity [11]. Indeed, interpersonal socialisation is more likely to be an effective facilitator of tacit knowledge sharing than IT: "In the digital era, there is still no perfect substitute for the motivational effects of human bonding and social connectedness" [24, p.33].

In parallel with the above research on the motivation to share knowledge, SNT also provides additional insights on the link between relationship network and information sharing. Social network researchers such as Granovetter [13] theorized that weak ties are more effective for gaining novel information than strong ties. More recently, however, attentions have been shifted to strong ties between the actors in social networks. For example, Hassan [16] has demonstrated that strong ties are critical in transferring tacit and complex knowledge. Similarly, Chow and Chan [11] suggest that the more the extensive social network among organizational members, the more favourable the attitude towards knowledge sharing. These social network-based views are consistent with TMT's emphasis on the contribution of memory network on knowledge management. Better knowing and access to a person can result in better knowledge seeking outcomes [25]. Organizational members will have more positive feelings about sharing ideas and resources with those with whom they have tight personal relationships. These arguments lead to the following hypothesis.

Hypothesis 3: The social network at work facilitates knowledge sharing in the workplace.

The social network is critical for team performance. Given the growing use of CMC tools at teams, understanding the factors that influence teamwork performance has become increasingly important. Studies, such as [6], have examined a variety of teamwork performance measures and the influencing factors in the context of virtual team. Specifically in Fuller et al.'s study [6], team performance includes perceptions of outcome satisfaction, team satisfaction and outcome quality, and an objective measure of team project grades in the context of online learning. In the organizational environment, we argue that socially networked teams can nurture a harmonious atmosphere for collaborative works. More importantly, a relationship network functions as an enabler of knowledge sharing by reducing the search costs of receivers and assuring the quality of knowledge, thereby allowing knowledge recipients in a team to achieve a higher level of teamwork outcomes by enhancing teamwork quality and satisfaction. With respect to knowledge quality, relationships could also play a role, as individuals who share strong relationships will provide mutual assurance of the reliability, richness and trustworthiness of the knowledge [26]. In this regard, relationship networks help a receiver reduce search costs and lead to better informed decisions at work [27], which implies that a relationship exerts a positive influence on team performance. From a network perspective, inter-dependence among individual actors in a work network fosters cooperation that in turn enhances group performance [28]. The higher the density of a network, the better the group performance that can be achieved [29]. Because of the mutual understanding of their own responsibilities as cooperative members in a network, employees in close workplace partnerships with their teammates can potentially enhance an entire team's performance. Accordingly, we hypothsize:

Hypothesis 4: The social network at work enhances team performance.

C. Shaping Team Performance by Knowledge Sharing

Team work can be effectively accomplished by utilizing procedures, processes, work methodologies, innovative ideas and mental models. Knowledge sharing can lead to enhanced team performance because sharing makes the above-mentioned information available for work. Increased frequency of discussion and knowledge sharing can enable more comprehensive consideration and comparison of alternatives, leading to improved decision making [30]. According to Okhuysen and Eisenhardt [31], members in a team which shares information over time can develop the capability to recognize, process and create knowledge in blocks or patterns

rather than discrete units. This learning capability in turn contributes to the team collective intuition [32].

In TMT, transactive memory refers to the knowledge of "who knows what" in a team [33], which is a basic requirement of a distributed knowledge system [25]. Team members begin to form a transactive memory when they disclose information indicating their specialized knowledge. Coordination can be facilitated because team members can anticipate each other's behavior. In a transactive memory network, the sharing of specialized knowledge, including mental models and suggested solutions to problems, is instrumental in the achievement of higher team performance. Empirically, the positive relationship between knowledge sharing and team performance has been verified in research focusing on empowering leadership, knowledge sharing and team performance [32]. In our research context, we argue that IM-enabled knowledge sharing has dramatically improved the efficiency of coordination and team work, benefitting from IM's "instant" nature. Taking all these arguments together, we suggest:

Hypothesis 5: Knowledge sharing in the workplace contributes to team performance.

D. Control Variables

In addition to IM, other CMC tools such as email, intranet, video conferencing, and knowledge sharing communities are commonly encountered in organizations as means to facilitate knowledge management and relationship building. The theories of communication performance such as media synchronicity theory (MST) [8] and CMC interactivity model [9] argue, conceptually, that the best medium for a given situation may be a combination of CMC tools because an integrated communication environment can balance the strengths and weakness of individual CMC tool. We thus control other CMC tools' effects on the research model.

III. METHODOLOGY

A. Measurement Development and Validation

We make use of existing measures in the literature to form the items used in the current study. The independent variable (IV), IM use at work, is measured by the adapted scales from [34] about the use of Electronic Knowledge Repositories at work. This construct includes the scales about the frequency of using IM in daily work for contacts and communication, asking questions, answering questions, sharing files, and work-related socializations. The measures of relationship network are derived from (1) Chow and Chan's [11] operation of social networks including good relationships and being close to organizational members; and (2) Arias' [10] conceptualization of relationship network, i.e., personal connections, ties, associations, as well as guanxi. The measures of knowledge sharing are taken directly from Bock et al.'s [7] research on knowledge sharing. Teamwork performance is measured by the scales developed and validated in Fuller et al.'s [6] study of technology-mediated distributed teams. So the measures of teamwork performance include three dimensions covering group satisfaction, outcome satisfaction and outcome quality. Regarding the other commonly used online communication tools, including use of email, video conferencing, intranet, and knowledge community, we ask the frequency of usage at work with the scale of never (1) to always (7) in order to control their effects on the research model.

Considering that the measures came from different sources, we conducted card sorting exercises to test the reliability and validity of the study's measurement items, following the method suggested by Moore and Benbasat [35]. The card-sorting judges were formed by one work professional, an academic scholar, and a research student. In the first round of the exercise, the judges were not provided with the construct names but were asked to label each item. In this round, the correct hit ratio was 85%. Based on the feedback provided by the judges, we revised some ambiguous wordings and the revised measures went to the second round of card sorting exercise conducted by a second group of judges with the same characteristics as the first group. In this round, the names of constructs were provided. A 97% correct hit ratio was achieved in this round, which indicates sufficient item-construct reliability [35] and so we did not proceed with a third-round of card sorting.

B. Sample

We collected data from working professionals in China, all of whom are part-time postgraduate students at one of the following universities: Tsinghua University (Beijing), University of Science and Technology of China (Hefei), Xi'an Jiao Tong University (Xi'an) and Shenzhen University (Shenzhen). We provided both hard-copy and online versions of the survey questionnaire to those working professionals attending the master courses in one specific university above. Over a period of four weeks, we sent out 381 invitation email for survey participation and collected 259 voluntary responses, a response rate of 68%. After removing invalid responses (i.e., those who failed to respond on ten or more survey items), a total of 253 valid responses was achieved, yielding a valid response rate of 66%. We assessed non-response bias according to the method recommended by Armstrong and Overton [36], viz.: (1) the respondents' demographic characteristics were similar to those currently registered at the universities concerned; and (2) the t-test of the demographic characteristics of the participants who responded in the first two weeks did not significantly differ ($p>.10$) from those who responded in the second two weeks. On this basis, response bias was not considered to be a concern. We also used the same method to test the variance of the responses to the hard-copy and the online version. No significant difference was found between these two sets of samples. Considering that the data was collected from four different cities, we also compared these four groups of respondents based on their demographics. The ANOVA test results showed insignificant differences in all comparisons between groups. Therefore all 253 responses (see Table II) were pulled together as the data set for subsequent statistical analysis.

TABLE II. DEMOGRAPHIC CHARACTERISTICS (N=253)

Items	Indicators	%	Items	Indicators	%
Gender	Male Female	62.9% 37.1%	Position	Non-Management Employee Manager Senior or Executive Manager	60% 22% 18%
Education level	Primary/ secondary school College Undergraduate Master or above	3.6% 21.8% 49.2% 25.4%	Age range	18-25 26–35 36–45 46 and above	24.6% 64.3% 9.9% 1.2%
Company Location	Beijing (The Capital, N. CN) Shenzhen (S. CN) Hefei (E. CN) Xi'an (W. CN)	22.9% 27.3% 27.3% 22.5%	Number of Employees	50 or below 51-100 101-500 501-1000 1001 or above	24.5% 16.1% 30.5% 11.2% 17.7%
Company History	1-5 years 6-10 years 11-25 years 26-50 years 51-100 years Over 100 years	28.0% 31.7% 17.9% 14.6% 4.9% 2.8%	Number of Different IM Tools (such as MSN, QQ, ICQ, Company Owned IM) Used at Work	None 1 2 3 4 5 or above	1.6% 13.3% 36.1% 36.5% 8.8% 3.6%
Industry Type	Public relations Manufacturing IT industry Commerce Education Tourism Entertainment Publishing Telecomm. Government Services Finance and Banking Logistics and Transportation Others	4.2% 18.4% 23.8% 5.9% 2.9% 6.3% 0.4% 5.0% 5.0% 7.1% 6.7% 0.8% 13.4%	Contacts in IM	None 1-10 11-20 21-50 51-99 100-200 201 or above	1.8% 23.6% 20.1% 29.7% 15.7% 7.8% 2.5%
			Contacts Related to Work in IM (%)	None 1%-20% 21%-40% 41%-60% 61%-80% 80%-100%	1.8% 17.4% 23.8% 26.2% 23.3% 10.8%

In the survey, we also asked respondents to report their frequency of using different IM tools at work. Table III provides an overall view of responses. Table III shows Tencent's QQ is the most popular IM tool, followed by Microsoft's MSN. Only 16.4% of respondents frequently used a company-owned IM at work. The high mean of the usage frequency (5.8 for QQ) indicates that most of the respondents do utilize IM tools at work.

TABLE III. FREQUENCY OF USING DIFFERENT IM TOOLS AT WORK (MULTIPLE SELECTIONS ARE ALLOWED)

IM Tools/ Use at Work (%)	1= Never	2	3	4	5	6	7= Always	Mean (STD)
Tencent QQ (n=253)	3.2	6.4	6.0	4.8	9.2	12.4	**58.2**	5.8 (1.8)
ICQ (n=253)	**55.0**	14.5	7.3	11.4	5.0	4.1	2.7	2.2 (1.7)
MSN (n=253)	14.8	7.4	5.7	16.0	16.8	13.5	**25.8**	4.6 (2.1)
Company-Owned (n=253)	**43.1**	4.9	7.1	7.1	8.9	12.4	16.4	3.4 (2.4)
Others (An Elective Question, n=77)	9.1	5.2	6.5	9.1	18.2	18.2	**33.8**	5.1 (2.0)

IV. DATA ANALYSIS

A. Measurement Validity

We used the Statistical Package for the Social Sciences (SPSS) and Partial Least Squares (PLS) to calculate construct validity and reliability. The convergent and discriminant validity are first confirmed by the factor analysis (see Appendix I): (1) the factor loading scores on their expected factors are all above 0.6. Moreover, the factor loading scores are much higher on their expected factors than the other factors (i.e., own loading scores are higher than cross loading scores); (2) all eigenvalues of the constructs are larger than the suggested value of 1.0; (3) the communality scores are all higher than the suggested value (0.50). These results indicate adequate reliability of measures [40].

Second, we validate the construct reliability by assessing the Cronbach's alphas and the composite reliability scores. Cronbach's alphas of all constructs range from 0.83 to 0.95; while all composite reliability scores are all above 0.90 (see Table IV), suggesting acceptable internal consistency [40]. Meanwhile, the square roots of the Average Variance Extracted (AVE) are at the level of 0.80 or above, which are greater than all other cross correlations. This shows that all constructs capture more construct-related variance than error variance [41]. Taken together, these results demonstrate adequate convergent and discriminant validity for all constructs.

TABLE IV. DESCRIPTIVE STATISTICS, CORRELATION MATRIX, AND AVE OF PRINCIPAL CONSTRUCTS

Principle Constructs	Composite Reliability	Variance Explained (Total: 65.8%)	1	2	3	4
1. IM Usage at Work	.91	15.0%	**.80**			
2. Social Network	.90	13.4%	.42**	**.80**		
3. Knowledge Sharing	.91	15.7%	.39**	.67**	**.91**	
4. Group Outcome	.92	21.7%	.35**	.63**	.59**	**.89**

Note: **Correlation significant at p<0.01 level. Diagonal elements are the square root of the average variance extracted (AVE) from their indicators; Off-diagonal elements are construct correlations.

We also tested for common method bias (i.e., variance attributed to measurement method rather than variance explained by the study's constructs). First, evidence for common method bias exists if one principal factor counts for the majority of the variance explained [37]. Our principal components factor analysis indicates that each principal factor explains roughly equal variance (13.4%~21.7%), suggesting the lack of substantial common method bias. Second, the correlation matrix (Table IV) shows that the highest inter-construct correlations are below 0.67, while common method bias is usually evidenced by extremely high correlations (r>.90) [38]. In sum, the above tests provided evidence that common method bias is not a serious problem.

Finally, to test for multicollinearity, collinearity diagnostics for constructs were also conducted. The analysis shows that the collinearity indicators – tolerance values and variance inflation factors – are all less than the acceptable cut-off points [39, 40]. These results indicate that this study does not suffer from severe multicollinearity problems.

B. Testing Second-Order Factors

For measuring the second-order constructs, we follow the method suggested by Chin et al. [42] and commonly adopted by the literature, such as [6, 7]. We first modelled the coefficients of each first-order factor (i.e., sharing implicit knowledge, and sharing explicit knowledge) to the second-order factor (knowledge sharing) using a principal components factor analysis; and then pulled the first-order factors together as the reflective measure of knowledge sharing in PLS for the statistical model. Figure 2 indicates that all first-order factors for knowledge sharing significantly loaded on the latent second-order factor. We also use the same method to evaluate the other second-order factor constructs, i.e., teamwork performance (see Figure 2). The results demonstrate the validity of the reflective second-order models.

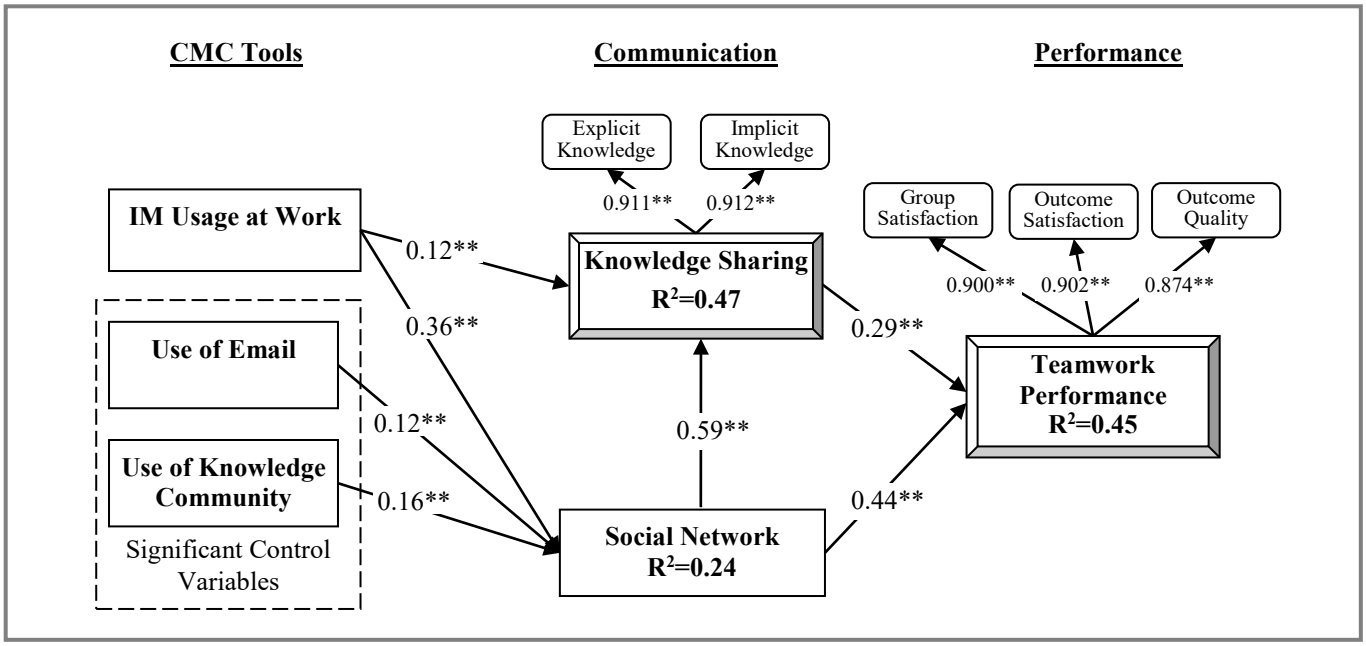

Figure 2: PLS Results of Structural Model with Second-Order Constructs

*Legend: **p<0.01; Bevels represent second-order factors. Rectangles represent first-order factors measured with reflective scales. Rounded rectangles represent first-order factors used as the reflective measures of the second-order factors. Only significant paths are shown.*

C. Testing the Research Model

The structural model in this study was examined by PLS. As shown in Figure 2, the PLS results indicate that the research model is supported by the data. The results show that IM use at work (b=0.36, p<0.01) has a significant impact on establishing a social network, supporting H1. Together with use of email and knowledge community, IM usage at work explains 24% of the variance of social network. Its effects on encouraging knowledge sharing are also significant (b=0.12, p<0.01), confirming H2. Regarding the impacts of social network on knowledge sharing and teamwork performance, the statistical results render support for H3 (b=0.59, p<0.01), and H4 (b=0.44, p<0.01). Together with IM usage at work, the social network explains 47% of the variance of knowledge sharing. The data also indicates a significant effect of knowledge sharing on teamwork performance (b=0.29, p<0.01), thus validating H5. Integrating knowledge sharing and social network, the total variance explained of team performance is 45%.

D. Robutness Check

Our premise of the current research model is that IM use at work contributes to teamwork performance through the building of social networks and facilitating knowledge sharing. In order to further verify the mediating effects of social networks and knowledge sharing, we follow Baron and Kenny's [43] testing method for mediation. An alternative model capturing the direct link from the IM use at work to teamwork performance was structured and tested in PLS. The results showed that the original significant direct effect of IM use at work on team performance (b=0.37, p<0.01) becomes insignificant (b=0.06, p>0.10) when social network and knowledge sharing are included in the model. This robust test provides additional support for the full mediating role of social network and knowledge sharing in the proposed model.

The data indicate participants with the age of 26-35 count for 64.5% of the total valid sample. In order to examine the influence of age in this study, we conducted several robustness tests. First, ANOVA test using age as the grouping factor indicated significant differences exist in IM usage, social network, knowledge sharing, but not teamwork performance where the participant group with the age of 36-45 (25 participants) resides at the significantly high end of construct value. This result suggests different age groups have created natural variance of construct values. Second, we added age as a moderator on the path between using IM and social network in the original research. A significant negative moderation effect was observed. This result suggests social networks at work are easier to be shaped among young employees. The moderating effect of age on the path between the use of IM and social network.

V. Discussion, Implications and Future Study

This research has several key findings. Firstly, although IM is generally considered as a social tool, our study demonstrates its empowerment of teamwork by establishing social networks and facilitating knowledge sharing among organizational members. Organizations are increasingly allocating complex tasks to teams, so such complex team works require more efficient communication and knowledge sharing for problem solving. Benefitting from IM's characteristic of instantaneous connections, the collaborative process among team members can be much smoother. Instant communication provides organizations with the opportunity to become real-time enterprises. Secondly, according to the results of the above robust check, IM's effects on empowering a higher level of teamwork performance are fully mediated by social networks and knowledge sharing. That means the adoption of IM tools at work won't automatically result in good team performance. Instead, the proper utilization of IM in building social networks and facilitating knowledge sharing are more important in visualizing the benefits of IM at work. This also suggests IM's instrumental function in forming social networks considering the contacts and connections are prerequisites for relationship networks. Thirdly, the social network is of high importance to both knowledge sharing (b=0.59) and teamwork performance (b=0.44). Positive relationships among organizational members allow them to overcome psychological barriers in knowledge sharing and teamwork. The relationship network, a long-lasting pattern of humanity, is being reshaped by evolutionary social technologies such as IM. Fourthly, email and knowledge community at work are found to significantly strengthen the social network in the work environment. Usually email and social knowledge community are configured in a company level. While the individual use of these two CMC tools has evidently helped establish a company-wide communication network and nourish strong personal relationships among employees.

From a theoretical perspective, this study answers the challenge to quantify the benefits of IM use at work for organizations. Integrating SNT and TMT, we argue that IM plays a major role in creating social networks and facilitating knowledge management in the workplace. The combination of various CMC tools in this study contributes to the theories of communication performance. Such a comprehensive and integrated communication environment provides employees with a range of ways to establish the social networks with the aid of CMC tools. MST [8] treats communication media, as treated "a conduit among participants" (p. 578). This study empirically confirmed MST's conceptual speculations that the use of multiple media, either concurrently or consecutively, will lead to stronger interpersonal relationships between participants and improve their communication performance. In addition, this study explicitly outlines the prominent roles of CMC technologies at work, extending the current theories of communication performance by including their technological antecedents. In addition, the validated conceptual research model supplements the existing studies on the social network by providing conceptual arguments for the untapped potential of social networks for organizations. This conceptual approach therefore adds additional granularity to the current prevailing symbolic denotation of social ties and provides an alternative theoretical lens to further investigate the efficacy of IM and social networks in organizations.

Practically, and as predicted by Gartner Research [44], IM will be the de facto tool for most knowledge workers by 2011. Meanwhile, knowledge sharing and management have long been considered a critical in various industries [45, 46]. Although IM is a double-edged sword, in this study we demonstrate how it facilitates the development of guanxi-based social networks of organizational members who effectively share information, knowledge and other resources thus contributing to teamwork performance. Organizations need to decide when and when not to introduce social technologies into team processes. The delegation of work to teams and knowledge workers in making better decisions and collaboration with technological tools can drive innovation. Also, as seen from this study in China, IM is a natural supplement of email, but not a replacement. The social aspect of IM communication has brought it an elevated position in work contexts compared to other IT applications that are simply transactional and diverting.

The current study has provided evidence on the bright side of IM use at work by outlining its empowerment of team members and so contriuting to team performance. Following this study, future research involving the dark side of IM use (such as security and work disturbance issues) can further extend our understanding on the pros and cons of this social tool. Meanwhile, social networking tools have been undergoing a process of continuous evolution. The utilization of social networking tools in the work context has become a broad but necessary research area if organizations are to reap the benefits. However, as noted by the Gartner researcher [5] "the number of companies that see the value of social networking is small". We expect future studies can employ various research methods to investigate the contributions of other social networking tools, such as wikis, blogs, and Twitter- or FaceBook-like platforms, to organizational performance. For example, a valuable perspective is to utilize the fruitful studies on service quality of technology (such as [47, 48] to investigate the reasons of adopting various CMC tools in work context. For a thorough examination of the use of IM on shaping work performance, future research can fully explore this important domain from the level of individual, team, and company with both subjective and objective measures.

VI. CONCLUSION

Social networking tools hold enormous potential for improving organizational performance, especially in distributed work and large enterprises. They help organizational members to achieve engagement, productivity and knowledge preservation goals at work. Among those social networking tools, IM is instrumental in the establishment of a well connected relationship network, which is a prerequisite for seamless team collaboration. During the course of collaboration, knowledge including procedures, processes, ideas, methods and mental models is fundamental for making better decisions and accomplishing team tasks. However, knowledge sharing tends to be either automatic or mandated. The forming of a good relationship network enabled by IM has delicately addressed this common knowledge problem. Meanwhile, IM is a cost-effective technology tool suitable for both simple and complex tasks. As shown by this empirical research, IM has demonstrated its potential to drive new forms of personal and business collaboration. We hope our findings are useful to others, including both academic and practitioners, as a compelling rationale to engage in social network research and utilization in organizations.

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APPENDIX I. MEASUREMENT ITEMS

IM Usage at Work, Scale: Strongly disagree (1) – Strongly agree (7)	Principle Component Analysis*
(1) I often use IM tools to contact other people for my work.	.713
(2) I regularly use IM tools to communicate with colleagues or customers in my daily work.	.795
The frequency of usage of IM tools to do the following things in my daily work is … Scale: Not at all (1) – Frequently (7)	
(3) Ask questions.	.799
(4) Answer questions.	.846
(5) Share files.	.766
(6) Work-related socialization.	.780
Social Network, Scale: Strongly disagree (1) – Strongly agree (7)	
(1) I have developed good relationships with my colleagues.	.741
(2) I have built a social network with my colleagues.	.816
(3) I have cultivated ties with my colleagues.	.751
(4) I have many good contacts related to my work.	.850
(5) I have established a guanxi network for work.	
Sharing Explicit Knowledge, Scale: Strongly disagree (1) – Strongly agree (7)	
(1) I and my colleagues share work reports and official documents with each other.	.650
(2) I and my colleagues share business manuals, models, methodologies with each other.	.749
(3) I and my colleagues share each other's success and failure stories.	.818
(4) I and my colleagues share business knowledge obtained from newspaper, magazines, journals, and television.	.729
Sharing Implicit Knowledge, Scale: Strongly disagree (1) – Strongly agree (7)	
(1) I and my colleagues share know-how from work experience with each other.	.811
(2) I and my colleagues share each other's know-where and know-whom knowledge.	.739
(3) I and my colleagues share expertise obtained from education and training with each other.	.815
Outcome Satisfaction, Scale: Strongly disagree (1) – Strongly agree (7)	
(1) I am satisfied with the project outcomes produced by my team.	.824
(2) I am pleased with the quality of my team's work.	.831
(3) I am satisfied with the final project deliverables that my team submits.	.790
Group Satisfaction, Scale: Strongly disagree (1) – Strongly agree (7)	
(1) I am satisfied with my group members.	.836
(2) I am pleased with the way my teammates and I work together.	.851
(3) I am satisfied working with my team.	.846
Outcome Quality, Scale: Strongly disagree (1) – Strongly agree (7)	
(1) The work produced by my team is of a high quality.	.840
(2) The project outcomes from my team are excellent.	.861
(3) The deliverables of my team are outstanding.	.850

* Own loading scores are listed in this table, which are all higher than cross loading scores.