Computer-mediated-communication and social networking tools at work

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Computer-mediated communication and social networking tools at work

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Abstract

Purpose – Advances in information technology (IT) have resulted in the development of various computer-mediated communication (CMC) and social networking tools. However, quantifying the benefits of utilizing these tools in the organizational context remains a challenge. In this study, the authors aim to investigate the effects of three specific tools, viz. instant messenger, email and knowledge forum, on facilitating the communication and social network at work, and their subsequent influence on individuals' work performance. Together with a social network diagram, the proposed model is validated by a survey of 59 employees of a company which embeds these three CMC and social networking tools in the work process. The key findings, implications and future research are discussed.

Design/methodology/approach – The authors verify the research model with data from the Hong Kong office of an international bank headquartered in London, UK. They also collected the data on the social networks of 59 employees to draw a network diagram of the respondents using the social network analysis software UCINET.

Findings – The research model is fully supported by the survey data. Meanwhile, the social networks analysis also suggests the linkage of using IM at work and the high level of degree and high level of closeness.

Originality/value – This study provided an empirical verification of media performance theories, evidenced by interactive tools such as IM and email. This research also directly linked the elements of social network, viz. degree, closeness and betweenness, with the CMC and social network tools, the communication, interactivity, relationship, and work performance.

Keywords Computer-mediated communication (CMC), Social network tools, Social network analysis, Work performance, Communication, Social networks

Paper type Research paper

1. Introduction

Communication is an important part of human activities. One of the core values of information systems (IS) is the utilization of technologies to facilitate communication in the workplace (Quan-Haase *et al.*, 2005). Accordingly, various computer-mediated-communication (CMC) technologies have been proposed and
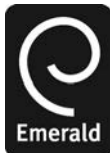
designed to enhance performance through improvements in communication. Under the larger umbrella of CMC technologies, social networking tools are designed to facilitate interlocutors' communication so as to strengthen their social relationships. Typical tools used in the workplace include instant messenger (IM), e-mail, knowledge sharing forums and company blogs. These CMC and social tools have recently become increasingly recognized as important for the workplace. Specifically, Deloitte (Gandal and Sharma, 2009) predicts that the key technological trend in this decade will be the use of information technology (IT) to shape social networks in organizations and subsequently enhance organizational performance. Social networking tools have gained momentum in practice. However, academic research has rarely investigated the impact of these technologies on the quality of social networks and interaction.

Parallel to the above practitioners' observations, there is a tradition of academic research focusing on technology adoption. This stream of research, for instance, media richness theory (Daft and Lengel, 1986) and technology adoption model (Davis, 1989), studied the influencing factors for individual or organizational choices with respect to media or technology adoption and use. In contrast to the focus of factors influencing technology adoption, a recent research area emphasizes the media and technology performance, namely, the outcomes of utilizing media or technology. Notably, media synchronicity theory (MST) focuses on the capability of media to support synchronicity, termed as a shared pattern of coordinated behaviour among individuals working together (Dennis *et al.*, 2008). MST also contends that the use of multiple media, either concurrently or consecutively, will lead to better communication and subsequently task performance because media synchronization can provide an ideal combination of media capabilities. MST, as "a theory of communication performance" (p. 579), thus offers a basis for theorizing how the use of CMC tools can spawn high-quality communication among buyers and sellers. Although MST has provided us with a conceptual cornerstone to investigate a technology's performance in the workplace, its empirical verification and its applications in examining CMC and social networking tools' performance in the workplace warrants investigation.

In order to address the above-mentioned research gaps, in this research we investigate the effectiveness of CMC and social networking tools on work performance through social network theory (Rogers, 1986) and MST (Dennis *et al.*, 2008). Specifically, we examine three CMC and social networking tools, namely, IM, e-mail and knowledge sharing forums, used in the workplace because of their popularity (cf., Gandal and Sharma, 2009). We argue that these three social networking tools can function as work task-oriented CMC tools. At the same time, these three CMC tools have the capability to shape well-connected social networks for the interlocutors at work, merging the interpersonal and work relationships together with the aid of CMC tools. With the utilization of these tools, quality communication process, interactivity and relationship networks among interlocutors can be established and strengthened, subsequently leading to enhanced individual work performance.

In the next section, we provide the theoretical justification for these arguments and develop corresponding hypotheses. We then describe the research context and the survey method, focusing on a work team covering 59 team members in a bank. Following the structural equation modelling and social network analyses, we summarize the findings and suggestions for the research. We conclude the chapter with implications and contributions.

2. Theoretical development

We rely on social network theory (Rogers, 1986) and MST (Dennis *et al.*, 2008) to develop the research model. Specially, Rogers (1986) defined communication as "a process in which participants create and share information with one another in order to reach a mutual understanding" and therefore a communication network is described as "the interpersonal linkages created by the sharing of information in the interpersonal communication structure, that is, the network". MST (Dennis *et al.*, 2008) focuses on the ability of media to support synchronicity, a shared pattern of coordinated behaviour among individuals as they work together. CMC tools used at work are designed to enhance the communication which may subsequently influence the work performance (cf., Quan-Haase *et al.*, 2005). Following these three streams of conceptual discussions, we propose that three specific CMC and social networking tools, namely, IM, e-mail and knowledge forums, have the potential to enhance individual employees' work performance by facilitating their communication process, enabling interactivity and building relationship networks in the workplace. The theoretical model is summarized in Figure 1. We detail the justifications to the hypotheses below.

2.1 The effects of IM used at work

IM as a communication tool has been described as a technology that allows "users to set up a list of partners who will be able to receive notes that pop up on their screens the moment one of them writes and hits the send button" (Castelluccio, 1999, p. 35). As a prominent CMC tool, IM can stimulate an instant reaction via a near-synchronous form of communication that closely resembles the openness and transparency associated with face-to-face interaction (Ou *et al.*, 2010). Scholars had suggested IM is impactful in enhancing active control (Nardi *et al.*, 2000), two-way communication (Li *et al.*, 2005) and synchronicity (Li *et al.*, 2005; Nardi *et al.*, 2000) which are building blocks of interactivity (Liu, 2003; Teo *et al.*, 2003). IM is thus considered as an impactful CMC tool to enhance communication quality. Although contradicting effects have been found in IM's effects on work interruption (Cameron and Webster, 2005), the positive influence of using IM in communication and enhanced team satisfaction is evident (Ou and Davison, 2011).

In the social context, scholars have highlighted IM's ease of use (Li *et al.*, 2005) and effects on developing friendships (Hu *et al.*, 2004). In the workplace context, Cho and his colleagues (Cho *et al.*, 2005) have provided the evidence, via a case study, for establishing a social network with IM. IM enhances mutual understanding of
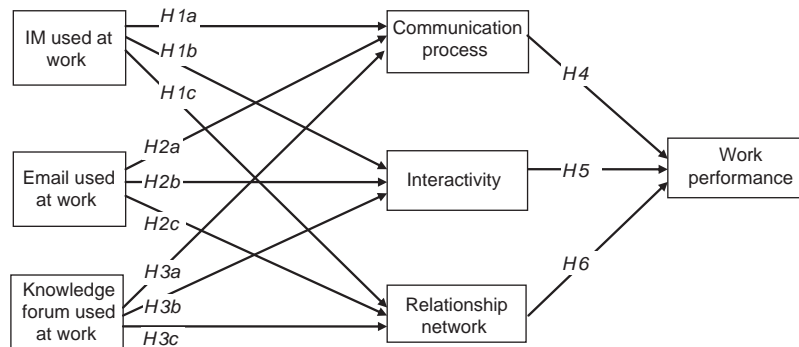

Figure 1.
The proposed
research model

individuals and thus promotes collaboration exchange. Employees can ask for, share and exchange knowledge with their contacts easily by using IM (Ou *et al.*, 2010). Through knowledge sharing in IM, people maintain a stable work relation with their contacts and hence guanxi networks can be formed. Integrating the above arguments, we thus propose that:

H1a. The use of IM at work has a positive effect on communication process.

H1b. The use of IM at work has a positive effect on interactivity.

H1c. The use of IM at work has a positive effect on relationship network.

2.2 The effects of e-mail used at work

In the past two decades, e-mail has become more and more popular in the workplace. Researchers have attempted to explain the effects of e-mail using different theories. For example, media richness theory (Daft and Lengel, 1986) suggests that e-mail is a leaner medium due to the text based and asynchronous nature of e-mail. However, a passive receiver of e-mail messages can act as an active participant by creating valuable meanings based on the text messages and create rich contents in the e-mail (DeSanctis and Poole, 1994; Lee, 1994; Ngwenyama and Lee, 1997). There is also evidence that communication richness depended on the interaction between the medium and its users rather than the medium itself. On the one hand, e-mail allows near-synchronous transfer of information. From this perspective, the use of e-mail at work has simplified the communication route by facilitating prompt responses between interlocutors, thus enhancing the interactivity and communication process. On the other hand, e-mail also allows interlocutors more time, especially in the work context, to organize their thoughts before putting them into the responses. From this perspective, e-mail is considered as a suitable CMC tool for equivocal communication tasks, even for establishing business strategies (Markus, 1994; Lee, 1994; Ngwenyama and Lee, 1997). Meanwhile, a single e-mail can be sent to the whole work team or relevant people in the company, easily reaching the whole work network and eliminating the spatial barriers. Therefore, we propose that:

H2a. The use of e-mail at work has a positive effect on communication process.

H2b. The use of e-mail at work has a positive effect on interactivity.

H2c. The use of e-mail has a positive effect on relationship networks.

2.3 The effects of knowledge forum used at work

Typical knowledge forums are the corporate portals providing organizations a workspace to generate and exchange knowledge based on rich and complex information. Most portals or knowledge forums enable content publishing in the workplace and the personalization of the interface. Publishing supports content creation, authorization, inclusion and includes the ability to render or publish documents, information and knowledge in the forum. Personalization allows users to modify their own interface. For instance, Microsoft SharePoint Design bundled with the Microsoft Office Professional is used to customize SharePoint portals. Personalization also enables the system (knowledge forum in this study) to dynamically deliver the most relevant information to

users in order to perform their job (Benbya *et al.*, 2004). Such a process can dramatically facilitate the communication process by embedding knowledge sharing in the work process. With the knowledge sharing forum, a company can provide employees with in-time relevant information they need to perform their duties and make efficient business decisions. For example, Voelpel and Han (2005) documented how Siemens's corporate knowledge sharing forum, namely ShareNet, supported tens of thousands of users and contributed to the employees' collaboration, even across the teams. The corporate knowledge from employees can be stored, retrieved and reused for achieving work objectives. During the exchange process, knowledge can be amplified and expanded, as evident in the case of ShareNet (Voelpel and Han, 2005). In spite of physical and geographical restrictions of employees, a knowledge forum provides a company with a huge relationship network to facilitate employees' sharing in a structured and digital environment. We therefore propose that:

H3a. The use of a knowledge forum at work has a positive effect on communication process.

H3b. The use of a knowledge forum at work has a positive effect on interactivity.

H3c. The use of a knowledge forum has a positive effect on relationship networks.

2.4 Shaping work performance with communication, interactivity and relationship network

According to Rogers (1986), communication is a process in which participants create and share information with one another in order to reach a mutual understanding, and therefore a communication network is described as "the interpersonal linkages created by the sharing of information in the interpersonal communication structure, that is, the network". Based on this concept of social network, Borzel (1998, p. 262) further suggested that "networks are based on communication and trust". Considering social networks represent the webs of personal relationships (Buckley *et al.*, 2006), we argue that communication between employees in a well-connected social network encourages employees to share information about business problems and processes. This is likely to improve the work performance of each individual in an organization (Mohr and Sohi, 1995). Interactivity captures the degree to which participants can modify the form and the content of a mediated environment with more active controls in a real time of dialogues (Steuer, 1992; Teo *et al.*, 2003; Liu, 2003). In the work environment, individual performance is improved if employees can ask questions and seek help from others through accurate, timely and effective communication (Mohr and Sohi, 1995; Rodwell *et al.*, 1998). This view is consistent with MST's (Dennis *et al.*, 2008) conceptual arguments that synchronicity (one dimension of interactivity in this study) contributes to the mutual understanding of interlocutors. We argue that socially networked teams and individuals can benefit from a harmonious atmosphere for collaborative work. 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 (Ou *et al.*, 2010), thereby allowing employees to achieve higher levels of outcomes by enhancing work quality. We therefore propose:

H4. Communication process has a positive effect on work performance.

H5. Interactivity has a positive effect on work performance.

H6. Relationship network has a positive effect on work performance.

3. Methodology

We operationalize the constructs based on the literature. The independent variables, IM, e-mail and knowledge forum used at work were measured based on the conceptualization provided by Kraut *et al.* (1992). We followed Dennis *et al.*'s (2008) conceptualization of MST to operationalize communication process as conveyance and convergence processes. The measures of interactivity covered active control, two-way communication and synchronicity, following (Liu, 2003; Lowry *et al.*, 2009). Relationship network captured the basic elements of the web of personal relationships, following Buckley *et al.* (2006). We measured the dependent variable – work performance – in terms of an employee's work standard, work quality and work performance level, using the scales from Rodwell *et al.* (1998).

We verify the above research model with organizational data. Global Bank (a pseudonym), an international bank headquartered in London, UK, is the focal point of this research. Global Bank emphasizes providing localized services to globally-distributed customers. Currently three CMC and social networking tools are employed in the company, namely IBM SameTime (an IM tool), Microsoft SharePoint portal (a knowledge sharing forum) and corporate Lotus Notes e-mail system. Appendix 1 lists the screen dumps of these three tools used in Global Bank. We selected Global Bank as the research focus because of its utilization of these three specific CMC and social networking tools in the workplace. Meanwhile, one of the authors worked in one major office of Global Bank, the Hong Kong office, with 61 staff in total. In order to verify the research model, he observed and collected survey responses from 59 employees in that office in 2010, yielding a response rate of 96.7 per cent. The data collected from one particular office, but not all branches of Global Bank, allows us to draw a meaningful social network diagram based on a naturally and physically connected workforce. Table I contains the demographic summary of all 59 respondents.

In addition to the structural research model, we also collected the data on the social networks of these 59 employees, intending to draw a network diagram of the respondents using the social network analysis software UCINET.

Items	%	Items	%
Gender		*Position*	
Male	72.88	Manager	15.25
Female	27.12	Assistant manager	55.93
Education level		Non-management employee	28.81
Bachelor degree	72.88		
Master degree or above	27.12	*Work history at Gobal Bank*	
Department		Less than 6 months	1.69
Finance	20.34	6 months-1 year	10.17
Investment	3.39	1-2 years	8.47
Information technology	72.88	2-5 years	71.19
Global technology	3.39	More than 5 years	8.47
Note: $n = 59$			

Table I.
Demographic summary

4. Data analysis

4.1 Measurement validation

We first used the Statistical Package for the Social Sciences (SPSS) to verify the validity and reliability of each construct. The convergent and discriminate validity are confirmed by the principal component factor analysis (Appendix 2). The factor loading scores on their expected factors are all above 0.7, where the own loading scores are higher than cross-loading scores. All eigenvalues of the constructs are larger than the suggested value of 1.0. The communality scores are all higher than the suggested value of 0.50. These results validate the reliability of measurements (Hair *et al.*, 1995). Then, the reliability of construct is confirmed by identifying the composite reliability scores which are all above 0.9 (Table II). Moreover, the square roots of the average variance extracted (AVE) are all above 0.87, which are greater than all other cross-correlations, suggesting these constructs capture more construct-related variance than error variance (Hair *et al.*, 1995). Therefore, the convergent and discriminate validity for all constructs in this study are confirmed by these results.

Common method bias is also tested in this study. Podsakoff and Organ (1986) suggested that common method bias exists when the distribution of the variance explained is heavily contributed by one principal factor (i.e. one principal factor counts for the majority of the variance explained). From our factor analysis table, each principal factor explains roughly equal variance (8.278-16.895 per cent). This suggested the lack of substantial evidence for common method bias. Second, another evidence for common method bias is that there are extremely high correlations between constructs ($r > 0.90$) (Bagozzi *et al.*, 1991). The correlation matrix (Table II) indicates that the highest inter-construct correlations are below 0.57, which indicates common method bias is not a concern. All the above tests suggested that common method bias is not a serious problem in this study.

Finally, collinearity indicators – tolerance values and variance inflation factors – were computed to test for multicollinearity. Diagnosis shows that collinearity indicators are all below the suggested cut-off values (Amoroso and Cheney, 1991; Hair *et al.*, 1995). These indicate that multicollinearity is not a problem in this study.

4.2 Testing the research model

After verifying the reliability and validity, we used partial least squares (PLS) to analyse the structural model. As show in Figure 2, the PLS results show that the model

Principal constructs	Mean (SD)	Composite reliability	1	2	3	4	5	6	7
IM used at work	6.0 (1.0)	0.928	0.875						
Knowledge forum used at work	2.5 (1.1)	0.937	−0.163	0.888					
E-mail used at work	3.6 (1.5)	0.954	0.051	−0.173	0.917				
Communication process	5.1 (1.4)	0.954	0.286*	−0.225	0.177	0.934			
Interactivity	5.4 (1.1)	0.909	0.292*	−0.217	0.221	0.335**	0.876		
Relationship network	5.7 (1.2)	0.982	0.384**	−0.161	0.182	0.364**	0.370**	0.950	
Work performance	5.7 (1.0)	0.973	0.272*	−0.127	0.205	0.397**	0.570**	0.450**	0.937

Notes: AVE, average variance extracted; diagonal elements are the square roots of the AVE from their indicators. Off-diagonal elements are correlations between the constructs. Correlations significant at *$p < 0.01$, **$p < 0.05$ levels, respectively

Table II.
Correlation table of principal constructs
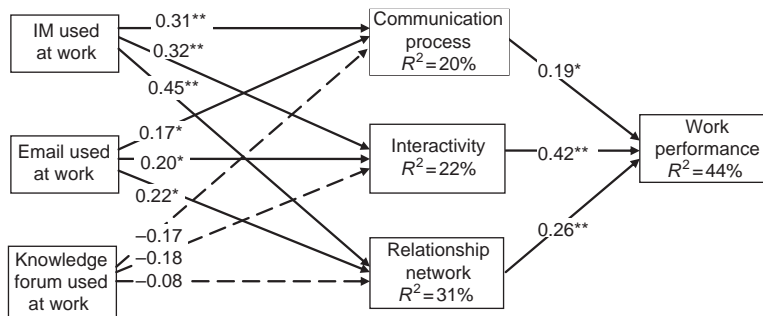
Notes: Bold lines represent significant paths; dashed lines represent
insignificant paths. *$0.01 < p < 0.05$; **$p < 0.01$

is supported by the data, except *H3a*, *H3b* and *H3c*. The results indicate IM used
at work has significant impacts on communication process ($b = 0.31$, $p < 0.01$),
interactivity ($b = 0.32$, $p < 0.01$) and relationship network ($b = 0.45$, $p < 0.01$), thus
supporting *H1a*, *H1b* and *H1c*. Also, e-mail used at work has significant impacts
on communication process ($b = 0.17$, $p < 0.05$), interactivity ($b = 0.20$, $p < 0.05$) and
relationship network ($b = 0.22$, $p < 0.05$), thus supporting *H2a*, *H2b* and *H2c*. On the
other hand, the impacts of knowledge forum used at work on communication process,
interactivity and relationship network are insignificant, rejecting *H3a*, *H3b* and *H3c*.
The PLS analysis also indicates communication process, interactivity and relationship
network have significant effects on employees' individual work performance, thus
supporting *H4* (communication process → work performance: $b = 0.19$, $p < 0.05$), and
H5 (interactivity → work performance: $b = 0.42$, $p < 0.01$) and *H6* (relationship
network → work performance: $b = 0.26$, $p < 0.01$). The variance explained to the
dependent variable, work performance, is 44 per cent. The level of variance explained,
together with the data support on the whole research model, suggests a sufficient
model fit.

4.3 Robustness check of the research model
Our premise of the above research model is that the CMC tools contribute to work
performance through social networks, namely, communication process, interactivity
and relationship network. An alternative model with direct linkage between CMC tools
and work performance was structured and tested in PLS, following the classical
testing method for the mediating effect of the mediators suggested by Baron and
Kenny (1986). The results showed that IM used at work has a significant direct effect
on work performance without any mediator ($b = 0.30$, $p < 0.05$). After communication
process, interactivity and guanxi is included in the model, it becomes insignificant. The
robustness test supports our contention that social networks fully mediate the path
between IM used at work and work performance in the proposed model. Then, the
same method is applied to test the mediating effects of the social networks on e-mail
and knowledge forum. The results showed that the original significant direct link
between e-mail and work performance ($b = 0.25$, $p < 0.05$) becomes insignificant after
the addition of social networks. The robustness test supports our contention that social
networks fully mediate the path between e-mail used at work and work performance in
the proposed model. For knowledge forum, its direct effect on work performance is not
significant.

4.4 Social network analysis

We also used UCINET to analyse the data related to the network diagram. 59 survey responses resulted in a social network diagram connecting 73 actors with 509 ties within the whole network (Figure 3). The network analysis indicates the network centralization index is only 10.86 per cent, suggesting the entire network's centralization is very low (Scott, 1991).

The degree, closeness and betweenness are three central elements of a social network (Wellman and Berkowitz, 1988; Freeman, 2006). Specifically, the degree refers to a node's (individual) ties to other actors (nodes) in the network, calculated by the number of ties. The betweenness refers to the degree an individual is near all other individuals in a network directly or indirectly, reflecting the ability to access information through the "grapevine" of network members. The closeness means the extent to which a node (individual) lies close to other nodes in the network. In this study, we examine the social networks at Global Bank focusing on these three central network elements, as well as their correlation between the social network elements and the theoretical constructs proposed in the research model. Because we used the asymmetric approach, i.e. allowing network member A to choose B in the network (the "out" arrow is indicated from A to B), but B does not necessarily choose A (the "in" arrow from B to A is not indicated). So the asymmetric matrix can represent unidirectional ties that go from a source to a receiver. We include "in" and "out" analysis in the correlation between the social network elements and the principal constructs shown in the research model (Table III). While betweenness suggests the "nearness" or connectivity of individual with all other individuals in a network directly or indirectly, so the calculation of betweenness considers both "in" and "out" as a link counted in the UCINET and results in only a non-directional connectivity.

As shown in Table III, the correlation analysis indicates that degree and closeness (covering the in- and out-relationships) significantly relates to the IM used at work. The data suggest the use of knowledge forum and e-mail are not related to degree,
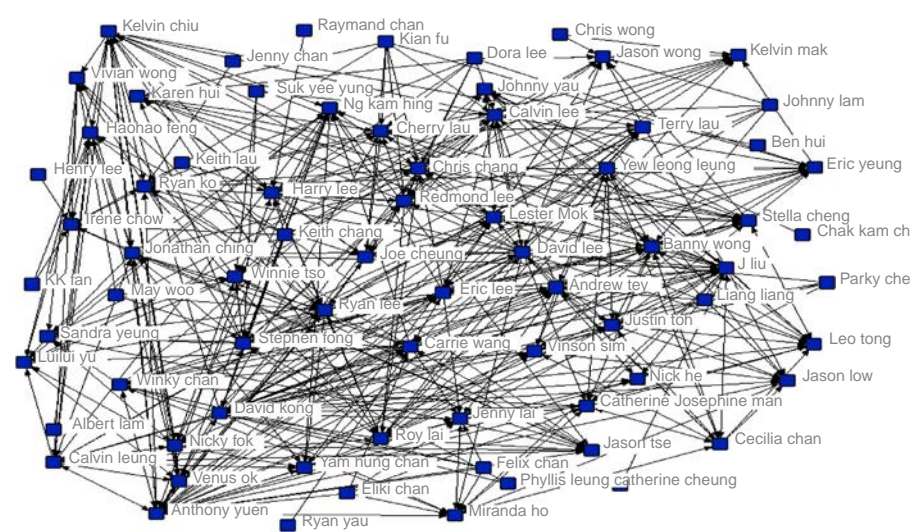

Figure 3.
The social network diagram of the survey respondents

Note: Pseudonyms used

Correlation tests	OutDegree	InDegree	InCloseness	OutCloseness	Between ness
IM used					
Pearson correlation	0.206*	0.203*	0.209*	0.040	0.147
Significance (*p*)	0.059	0.061	0.056	0.381	0.133
Knowledge forum used					
Pearson correlation	0.070	−0.035	−0.040	0.002	0.063
Significance (*p*)	0.300	0.397	0.382	0.493	0.316
E-mail used					
Pearson correlation	−0.075	0.140	0.115	0.157	−0.054
Significance (*p*)	0.286	0.144	0.194	0.117	0.343
Interactivity					
Pearson correlation	−0.058	0.317**	0.305**	−0.016	0.148
Significance (*p*)	0.331	0.007	0.009	0.453	0.131
Communication process					
Pearson correlation	−0.091	−0.012	−0.023	−0.159	0.020
Significance (*p*)	0.247	0.464	0.432	0.115	0.439
Relationship network					
Pearson correlation	−0.016	0.252**	0.245**	−0.038	0.070
Significance (*p*)	0.454	0.027	0.031	0.387	0.299
Work performance					
Pearson correlation	−0.281**	0.137	0.175*	−0.204*	−0.157
Significance (*p*)	0.015	0.150	0.093	0.060	0.117

Notes: $n = 59$. *$0.01 < p < 0.05$; **$p < 0.01$

Table III.
Correlation table of social network elements and the conceptual constructs

closeness and betweenness. The conveyance and convergence communication process are not significantly related to the social network elements. However, the perception of interactivity is significantly related to InDegree ($b = 0.317$, $p < 0.01$) and InCloseness ($b = 0.305$, $p < 0.01$). Similarly, the relationship network is found to be significant related to InDegree ($b = 0.252$, $p < 0.05$) and InCloseness ($b = 0.245$, $p < 0.05$). Work performance is found to be significantly related to OutDegree ($b = −0.281$, $p < 0.05$) and OutCloseness ($b = −0.204$, $p < 0.05$) with negative relationships, but significantly related to InCloseness ($b = 0.175$, $p < 0.10$). We discuss these findings and the corresponding implications in the next section.

5. Key findings, implications and future research
5.1 Key findings
There are several key findings in this study. The effectiveness of CMC and social networking tools on work performance is the central contribution of this study. Evidence is found on the contributions of IM and e-mail to individual work performance through building up social networks in the workplace. The data indicates that the SharePoint portal, namely, the knowledge forum, is yet to be an effective CMC tool in the workplace. We speculate that this is due to the overwhelming effect of IM and e-mail on shaping the communication, interactivity and social network via more private channels instead of the broadcasting format of the knowledge forum. Another speculation relates to SharePoint's relative ineffectiveness in establishing immediate interactions among employees. These findings suggest that social networks focus on one-to-one relationship building, instead of mass-level (many-to-many) communications. At the same time, interactive tools such as IM and e-mail are better utilized in

organizations for a rapid turnover of communication, at least as evidenced by Global Bank's Hong Kong office.

Meanwhile, our robustness tests on the research model suggest the full mediating effect of communication process, interactivity and relationship network on the path between the social network tools and work performance. Consistently, our data suggest the centrality of social network, although not directly exerting impacts on employees' work performance, significantly correlates with the use of CMC tools as well as employees' communication process, interactivity and relationship networks. So the interaction among employees and the establishment of relationship networks are demonstrated to be the essential factors that lead to improving individual work performance. Such findings imply managerial efforts should be paid to facilitate the communication process, interactivity and relationship network so as to improve the individual work performance.

Consistent with the above findings from SPSS and PLS, the social networks analysis also suggests the linkage of using IM at work and the high level of degree (the number of ties to other actors in the network) and high level of closeness. Although the social network elements did not show a strong correlation with the communication process, their relationships with interactivity and relationship network social network are evident, implying the strong social network can be utilized to improve work performance. Interestingly, both OutDegree and OutCloseness are found to be negatively correlated to work performance. We speculate that outgoing dialogues with other actors in the social network may cause work interruptions and thus negatively correlate to work performance. Contradictory to our original expectation, betweenness of a social network, namely, individual's connectivity to other actors in the network, is found to be insignificantly correlated to all the principal constructs in the research model. We speculate this unexpected result can be explained by the low network centralization index at Global Bank, which is only 10.86 per cent. This implies very low level of centralized access to information or resources in the whole network. In line with the low network centralization index, the insignificant correlation between the betweenness scores and the principal constructs in the research model indicate that the network does not exhibit much control by a few individuals over the access to the other actors, the information, communication or other resources in the network.

5.2 Implications

Intensive research has previously focused on the choice of media, but not media performance. Dennis *et al.* (2008) contributed a comprehensive conceptual discussion in this respect. Theoretically, this study extends the research on media performance by linking the CMC and social networking tools with work performance and its determinants, namely, communication process, interactivity and relationship network. These three components have shown their significant powers on measuring and predicting the performance of media (i.e. the CMC and social networking tools in this study) at work. Although the MST (Dennis *et al.*, 2008) has suggested that synchronicity can contribute to the mutual understanding among interlocutors, this research has gone beyond MST by articulating the rational behind – the contribution of the social network – in creating employees' mutual understanding in the workplace.

Practically, this study provided an empirical verification of media performance theories, evidenced by interactive tools such as IM and e-mail. In addition to the structural research model, the social network analysis empirically verified the effectiveness of the CMC and social networks tools in shaping employees' relationship networks with the evidence of the 509 ties in the network. In addition to the extension

of MST in studying CMC tools, this research also directly linked the elements of social network, namely, degree, closeness and betweenness, with the CMC and social network tools, the communication, interactivity, relationship and work performance. To the best of our knowledge, it is among the few studies empirically examining the social network elements with conceptual constructs. Together with the structural research model, social network analysis in this study demonstrates its significance in examining the media performance at work.

5.3 Future research
In this study, we only examined the positive effects of CMC and social networking tools in the workplace. Future research on comparing the advantages and disadvantages of using these CMC and social networking tools and addressing their impacts on individual performance can enhance the entire study. The current study has employed the MST, which also argues that communication tools perform differently under different situations. "Situation" is not considered in this study, which might have an impact on the "media performance" in the three studied CMC and social networking tools. Finally, this study only examines three CMC and social networking tools in workplace. Future studies can expand the study to include other social networking tools (such as Wiki, Weblogs, Micro-Blogs, Facebook and Twitter) on work performance to further investigate the potentials of using CMC and social networking tools in the workplace.

6. Conclusion
Communication is essential in the workplace. Along with the technology advancement, new CMC and social networking tools have become available to facilitate the communication and knowledge dissemination in organizational context. The utilization of such technology as IM, e-mail and knowledge forum has led to an increasingly mobile but better connected workforce. This study provides a compelling rationale to embed CMC and social networking tools into the work context. The implementation of these CMC and social networking tools are necessary for a company to shape employees' work performance and therefore remain competitive and agile in today's market and in the future. We believe more theoretical research and practical development will emerge in this field.

References

Amoroso, D.L. and Cheney, P.H. (1991), "Testing a causal model of end-user application effectiveness", *Journal Management Information Systems*, Vol. 8 No. 1, pp. 63-89.

Bagozzi, R.P., Yi, Y. and Phillips, L.W. (1991), "Assessing construct validity in organizational research", *Administrative Science Quarterly*, Vol. 36 No. 3, pp. 421-458.

Baron, R.M. and Kenny, D.A. (1986), "The moderator-mediator variable distinction in social psycological research – conceptual, strategic, and statistical considerations", *Journal of Personality and Social Psycology*, Vol. 51 No. 6, pp. 1173-1182.

Benbya, H., Passiante, G. and Belbaly, N. (2004), "Corporate portal: a tool for knowledge management synchronization", *International Journal of Information Management*, Vol. 243 No. 3, pp. 201-220.

Borzel, T.J. (1998), "Organizing Babylon – on the different conceptions of policy networks", *Public Administration*, Vol. 76 No. 2, pp. 253-273.

Buckley, P.J., Clegg, J. and Tan, H. (2006), "Cultural awareness in knowledge transfer to China: the role of Guanxi and Mianzi", *Journal of World Business*, Vol. 41 No. 3, pp. 275-288.

Cameron, A.F. and Webster, J. (2005), "Unintended consequences of emerging communication technologies: instant messaging in the workplace", *Computers in Human Behaviour*, Vol. 21 No. 1, pp. 85-103.

Castelluccio, M. (1999), "E-mail in real time", *Strategic Finance*, Vol. 81 No. 3, pp. 34-37.

Cho, H.K., Trier, M. and Kim, E. (2005), "The use of instant messaging in working relationship development: a case study", *Journal of Computer-Mediated Communication*, Vol. 10 No. 4, available at: http://jcmc.indiana.edu/vol10/issue4/cho.html

Daft, R.L. and Lengel, R.H. (1986), "Organizational information requirements, media richness and structural design", *Management Science*, Vol. 32 No. 5, pp. 554-571.

Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, Vol. 13 No. 3, pp. 319-339.

Dennis, A.R., Fuller, R.M. and Valacich, J.S. (2008), "Media, tasks, and communication processes: a theory of media synchronicity", *MIS Quarterly*, Vol. 32 No. 3, pp. 575-600.

DeSanctis, G. and Poole, M.S. (1994), "Capturing the complexity in advanced technology use: adaptive structuration theory", *Organization Science*, Vol. 5 No. 2, pp. 121-147.

Freeman, L. (2006), *The Development of Social Network Analysis*, Empirical Press, Vancouver, ISBN 1594577145.

Gandal, J. and Sharma, A. (2009), "Deloitte unveils 2009 global predictions for media industry", Deloitte's official website, available at: www.deloitte.com (accessed 29 April 2013).

Hair, J.F. Jr, Anderson, R.E., Tatham, R.L. and Black, W.C (1995), *Multivariate Data Analysis With Readings*, Prentice Hall, Englewood Cliffs, NJ, ISBN 0812239296.

Hu, Y., Wood, J.F., Smith, V. and Westbrook, N. (2004), "Friendships through IM: examining the relationship between instant messaging and intimacy", *Journal of Computer-Mediated Communication*, Vol. 10 No. 1, available at: http://jcmc.indiana.edu/vol10/issue1/hu.html

Kraut, R., Fish, R., Root, B. and Chalfonte, B. (1992), "Informal communication in organizations", in Baecker, R. (Ed.), *Groupware and Computer Supported Cooperative Work*, Morgan Kaufman, California, CA, pp. 287-314.

Lee, A.S. (1994), "Electronic mail as a medium for rich communication: an empirical investigation using hermeneutic interpretation", *MIS Quarterly*, Vol. 18 No. 2, pp. 143-157.

Li, D., Chau, P.Y.K. and Lou, H. (2005), "Understanding individual adoption of instant messaging: an empirical investigation", *Journal of the Association for Information Systems*, Vol. 6 No. 4, pp. 102-129.

Liu, Y. (2003), "Developing a scale to measure the interactivity of websites", *Journal of Advertising Research*, Vol. 43 No. 2, pp. 207-218.

Lowry, P.B., Romano, N.C., Jenkins, J.L. and Guthrie, R.W. (2009), "The CMC interactivity model: how interactivity enhances communication quality and process satisfaction in lean-media groups", *Journal of Management Information Systems*, Vol. 26 No. 1, pp. 155-196.

Markus, M.L. (1994), "Electronic mail as medium of managerial choice", *Organization Science*, Vol. 5 No. 4, pp. 502-527.

Mohr, J. and Sohi, R.S. (1995), "Communication flows in distribution channels: impact on assessments of communication quality and satisfaction", *Journal of Retailing*, Vol. 71 No. 4, pp. 393-416.

Nardi, B.A., Whittaker, S. and Bradner, E. (2000), "Interaction and outeraction: instant messaging in action", *Proceedings of CSCW'2000*, pp. 79-88.

Ngwenyama, O.K. and Lee, A.S. (1997), "Communication richness in electronic mail: critical social theory and contextuality of meaning", *MIS Quarterly*, Vol. 21 No. 2, pp. 145-167.

Ou, C.X.J. and Davison, R.M. (2011), "Interactive or interruptive? Instant messaging at work", *Decision Support Systems*, Vol. 52 No. 1, pp. 61-72.

Ou, C.X.J., Davison, R.M., Zhong, X.P. and Li, Y. (2010), "Empowering employees through instant messaging", *Information Technology & People*, Vol. 23 No. 2, pp. 193-211.

Podsakoff, P.M. and Organ, U.W. (1986), "Self-reports in organizational research: problems and prospects", *Journal of Management*, Vol. 12 No. 4, pp. 531-544.

Quan-Haase, A., Cothrel, J. and Wellman, B. (2005), "Instant messaging for collaboration: a case study of a high-tech firm", *Journal of Computer-Mediated Communication*, Vol. 10 No. 4, available at: http://jcmc.indiana.edu/vol10/issue4/quan-haase.html

Rodwell, J., Kienzle, R. and Shadur, M. (1998), "The relationship away work-related perceptions, employee attitudes, and employee performance: the integral role of communication", *Human Resource Management*, Vol. 37 Nos 3-4, pp. 277-293.

Rogers, E.M. (1986), *Communication Technology: The New Media in Society*, The Free Press, New York, NY, ISBN 002927110X.

Scott, J. (1991), *Social Network Analysis: A Handbook*, Sage Publications, Newbury Park, CA, ISBN 0803984804.

Steuer, J. (1992), "Defining virtual reality: dimensions, determining telepresence", *Journal of Communication*, Vol. 42 No. 4, pp. 73-93.

Teo, H., Oh, L., Liu, C. and Wei, K.K. (2003), "An empirical study of the effects of interactivity on web user attitude", *International Journal of Human-Computer Studies*, Vol. 58 No. 3, pp. 281-305.

Voelpel, S.C. and Han, Z. (2005), "Managing knowledge sharing in China: the case of Siemens Sharenet", *Journal of Knowledge Management*, Vol. 9 No. 3, pp. 51-63.

Wellman, B. and Berkowitz, S.D. (Eds) (1988), *Social Structures: A Network Approach*, Cambridge University Press, Cambridge, ISBN 0521286875.

Further reading

Dennis, A.R. and Kinney, S.T. (1998), "Testing media richness theory in the new media: cues, feedback, and task equivocality", *Information Systems Research*, Vol. 9 No. 3, pp. 256-274.

(The Appendix follows overleaf.)

Appendix 1. Three CMC and social networking tools used in Global Bank

Figure A1.
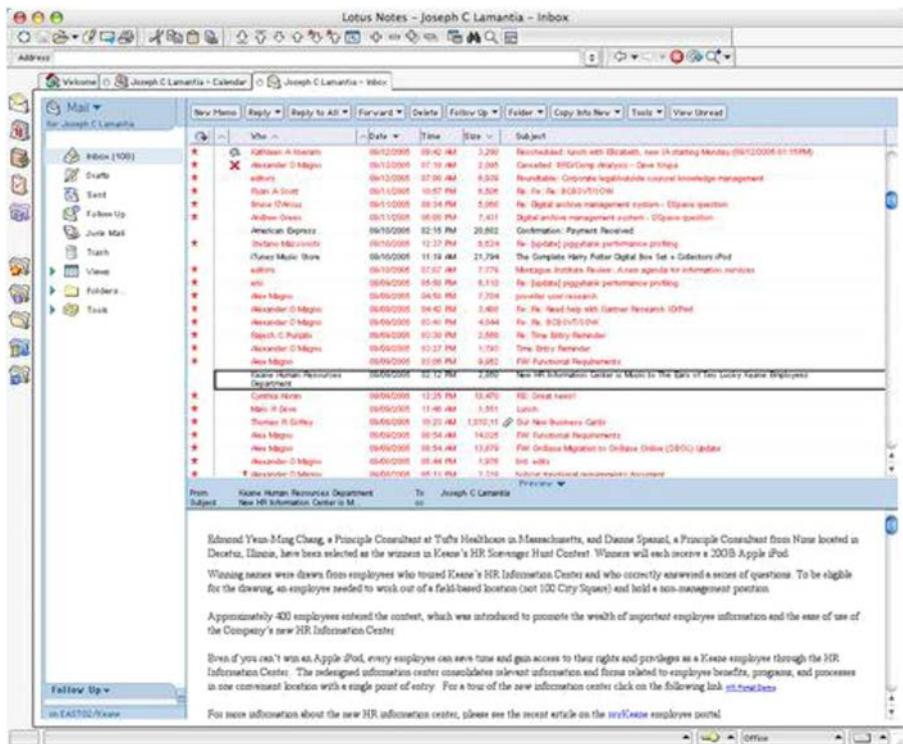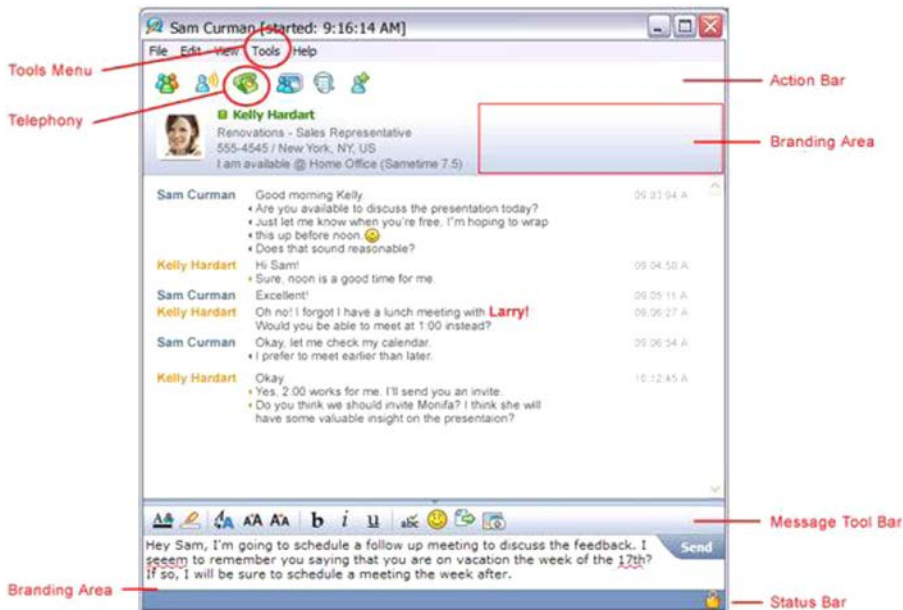Chat windows of IBM
lotus sametime connect 7.5

Figure A2.
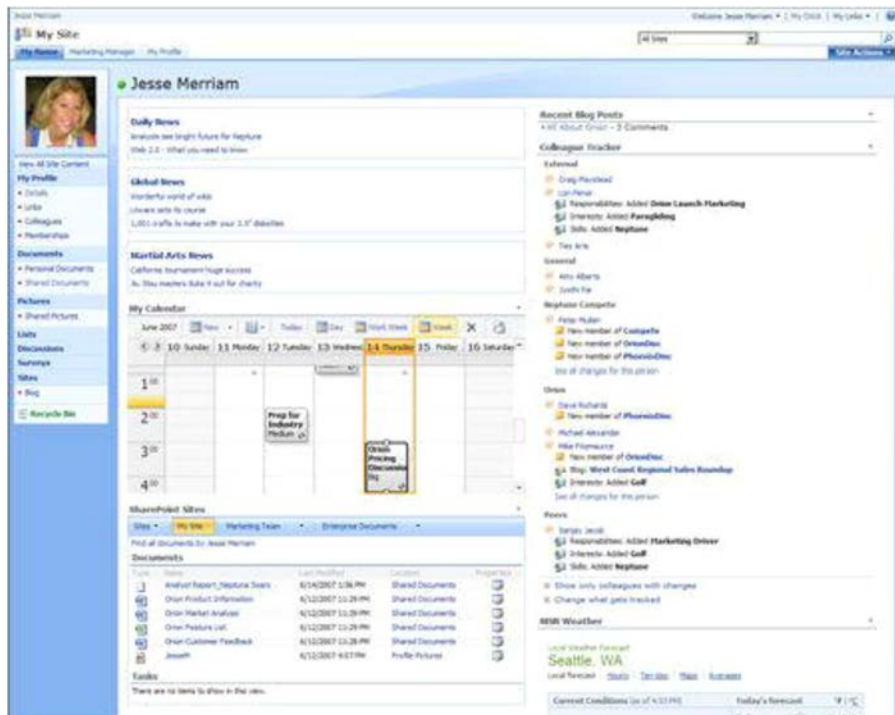The e-mail function
of lotus notes

Figure A3.
Customized Microsoft
SharePoint portal

Appendix 2. Measurement items

SameTime (i.e. the IM) used at work
Lotus Sametime (i.e. the IM) is used in:

(1) 1. Scheduled in advance – 7. Unscheduled

(2) 1. Arranged Participants – 7. Random participants

(3) 1. Present agenda – 7. Unarranged agenda

(4) 1. One-way – 7. Interactive

SharePoint (i.e. the Knowledge Forum) used at work
Microsoft SharePoint portal (i..e. the Knowledge forum) is used in:

(1) 1. Scheduled in advance – 7. Unscheduled

(2) 1. Arranged Participants – 7. Random participants

(3) 1. Present agenda – 7. Unarranged agenda

IBM Lotus Notes (i.e. the e-mail) used at work
IBM Lotus Notes (i.e. the e-mail) is used in:

(1) 1. Scheduled in advance – 7. Unscheduled

(2) 1. Arranged Participants – 7. Random participants

(3) 1. Present agenda – 7. Unarranged agenda

(4) 1. One-way – 7. Interactive

Communication process
Communication process in my daily work in general can be characterized as with:

(1) 1. Low-quality information – 7. High-quality information

(2) 1. Specific format – 7. Various format

(3) 1. Specific sources – 7. Multiple sources

Interactivity, Scale: Strongly Disagree (1) – Strongly Agree (7)

(1) I felt that I had a great deal of control over my communication with colleagues.

(2) I can have two-way communication easily with colleagues.

(3) My colleagues processed my input very quickly.

Relationship Network, Scale: Strongly Disagree (1) – Strongly Agree (7)

(1) My friends at work and I help each other when necessary.

(2) I have built a kind of personal relationship network at work.

(3) I have a good relationship network for work.

(4) People in this company get on with each other harmoniously.

(5) I have built a good relationship with my colleagues and supervisors.

Work Performance, Scale: Strongly Disagree (1) – Strongly Agree (7)

(1) I am currently working at my best performance level.

(2) I am one of the best at the work.

(3) I set very high standards for my work.

(4) My work is always of high quality.

(5) I am proud of my work performance.

Questions/ person communicated with	Person 1	Person 2	Person …	Person n
Full name (first name + last name)				
Time known (1: <6 months, 2: 6 months –1 year, 3: 1-2 years, 4: 2-3 years, 5: over 3 years)				
Interaction frequency (1: daily, 2: weekly, monthly, 4: quarterly, 5: less often)				

Table AI.
Items for social network diagram

Appendix 3

Component	1	2	3	4	5	6	7
IMUsedAtWork1	0.127	0.101	0.075	−0.077	0.888	0.161	0.144
IMUsedAtWork2	0.338	0.269	0.075	0.016	0.748	0.109	−0.064
IMUsedAtWork3	0.024	0.02	−0.074	−0.029	0.855	−0.017	0.107
IMUsedAtWork4	0.218	0.023	−0.063	−0.156	0.873	0.114	0.091
KnowledgeForumUsedAtWork1	−0.112	−0.002	−0.116	0.896	−0.081	−0.11	−0.093
KnowledgeForumUsedAtWork2	−0.127	0.032	−0.079	0.852	−0.132	−0.153	0.047
KnowledgeForumUsedAtWork3	0.059	−0.066	−0.069	0.881	−0.084	−0.004	−0.028
KnowledgeForumUsedAtWork4	−0.058	−0.109	−0.015	0.877	0.061	−0.032	−0.124
EmailUsedAtWork1	0.039	0.041	0.947	−0.016	0.068	0.033	0.032
EmailUsedAtWork2	0.162	0.032	0.906	−0.079	−0.039	0.140	0.091
EmailUsedAtWork3	0.068	0.15	0.886	−0.159	0.116	−0.026	0.12
EmailUsedAtWork4	0.016	0.095	0.875	−0.043	−0.151	0.053	0.035
CommunicationProcess1	0.083	0.251	−0.012	−0.082	0.103	0.852	0.105
CommunicationProcess2	0.167	0.120	0.085	−0.084	0.135	0.906	0.125
CommunicationProcess3	0.235	0.170	0.135	−0.144	0.080	0.878	0.103
Interactivity1	0.214	0.337	0.006	−0.059	0.016	0.133	0.810
Interactivity2	0.105	0.237	0.122	−0.076	0.180	0.143	0.766
Interactivity3	0.153	0.185	0.143	−0.073	0.104	0.073	0.827
RelationshipNetwork1	0.885	0.182	0.068	−0.065	0.178	0.170	0.169
RelationshipNetwork2	0.908	0.221	0.087	−0.043	0.132	0.120	0.081
RelationshipNetwork3	0.897	0.152	0.079	−0.104	0.159	0.052	0.134
RelationshipNetwork4	0.933	0.119	0.040	−0.047	0.091	0.099	0.089
RelationshipNetwork5	0.898	0.266	0.066	−0.032	0.132	0.143	0.091
WorkPerformance1	0.273	0.864	0.049	−0.016	0.049	0.180	0.244
WorkPerformance2	0.157	0.900	0.027	0.008	0.094	0.125	0.199
WorkPerformance3	0.271	0.853	0.093	−0.037	0.038	0.224	0.189
WorkPerformance4	0.074	0.844	0.105	−0.138	0.150	0.039	0.231
WorkPerformance5	0.214	0.906	0.122	−0.015	0.065	0.116	0.029
Eigenvalues	4.731	4.451	3.437	3.229	3.136	2.662	2.318
Variance explained							
Total variance = 85.583% (%)	16.90	15.90	12.28	11.53	11.20	9.51	8.28

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Table AII.
Principal component
factor analysis with
Varimax rotation

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