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Web 2.0 and Communication Processes at Work:

Evidence from China

Louie HM Wong[a,1], Carol XJ Ou[b], Robert M Davison[a], Hui Zhu[b] and Cheng Zhang[c]

[a]City University of Hong Kong, Kowloon, Hong Kong

[b]Tilburg University, Tilburg, The Netherlands

[c]School of Management, Fudan University, Shanghai, 200433, China

[1]Corresponding author, e-mail: louiehmwong@gmail.com

Abstract

Research problem: Web 2.0 applications, such as instant messengers and other social media platforms, are fast becoming ubiquitous in organizations, yet their impact on work performance is poorly understood. **Research question:** What is the relationship between web 2.0 use and work-based communication processes and outcomes in China? **Literature review:** Literature in the fields of information systems and media and communication research is supportive of the value of Web 2.0 for organizations. However, how Web 2.0 can facilitate the organizational communication process and subsequently improve performance is under-investigated. By adapting and extending the communicative ecology framework and previously published work, we develop and test a theoretical model in order to investigate these impacts in the Chinese workplace. **Methodology**: We conduct a quantitative study using the survey method with participants being randomly selected from a panel database in China. **Results and Conclusions**: We analyze survey data from 179 organizational employees and find that vertical and horizontal communication contribute significantly to individual and teamwork performance, with high levels of variance explained. In this study,

we provide empirical evidence of how Web 2.0 applications enable employees to reach out to collaborators and business partners, thereby boosting individual productivity and team collaboration. The study also highlights the fit between Web 2.0 and the need for organizational horizontal communication in this era of knowledge, information and creativity. In future researchers should verify the research model in different countries, including local contextual characteristics as either independent variables or moderators.

Keywords

Web 2.0; Social media; Communicative ecology framework; Work performance

Introduction

Web 2.0 applications, such as instant messengers and other social media platforms, are not only ubiquitous in our personal lives but they are fast becoming common at work as well. An increasing number of researchers have started to extend investigations of Web 2.0 applications beyond the social context into the workplace, assessing the impact that Web 2.0 applications has on actual work practices. However only a small number of studies (e.g., [1]-[5], [8]) have examined the phenomenon in China. In this paper, we specifically examine the situation in China, surveying employees across a wide range of industries with respect to the impact of Web 2.0 applications on their communication processes and the consequent performance outcomes.

Recent evidence [1]-[2], [4]-[8] suggests that Web 2.0 applications are widely adopted in the Chinese workplace, where they enhance a variety of work related processes, including collaboration, problem solving and information sharing. Not all companies are equally enthusiastic, however, and some do attempt to restrict employees' access to Web 2.0 applications at work [9]. Their hesitations on adopting Web 2.0 applications are understandable since the use of Web 2.0 applications may bring potential risks to the

workplace such as security and privacy (e.g. [10] and [11]). Nonetheless, as a form of communication media, we find that Web 2.0 applications are extensively used for a variety of communication purposes: inside the organization and beyond it; vertically (e.g. from senior to junior levels) and horizontally (e.g. between peers, business partners or between a sales team and its customers).

In China, the most popular Web 2.0 applications include: RenRen (a social media platform akin to Facebook), Youku (a video sharing site akin to YouTube) and Sina Weibo (a microblog site similar to Twitter). Instant messengers are also very popular, including WeChat (popular globally, yet developed by Chinese firm Tencent), and QQ (an indigenous messenger similar to the now terminated MSN, also developed by Tencent, yet with additional functionality such as news feeding, voice messages, file sharing and video calls).

Given both the eclectic mix of Web 2.0 applications in our social lives and a socially normative culture that favours this form of informal communication [12], their legitimate deployment in organizations and the positive impacts on work performance are less well understood (cf. [8]). Therefore, we were inspired to ask: What is the relationship between web 2.0 use and work-based communication processes and outcomes in China?

To answer this question, we adapt and combine the communicative ecology framework (CEF) [13] and the Web 2.0 and organizational communication (W2OC) model [8], creating a new theoretical model specific to the way in which Web 2.0 applications enhance communication processes and outcomes in the workplace. The combination of the CEF and W2OC model provides a solid theoretical foundation for us to develop our new theoretical model. It provides us with the means of engaging in a survey-based exploration of the communicative ecology context in the Chinese workplace. Hence, we complement the interpretive perspective of Davison et al. [8] and contribute to a more comprehensive account

of the phenomenon. We test this model with data obtained through a survey of employees (n=179) i0n a variety of Chinese firms.

Following this introduction, we briefly review the relevant literature before proposing a theoretical model at the end of the literature review section. We then explain our research methods and present our survey findings under the Methodology and Results sections respectively. We conclude the paper with a discussion of practical and research implications, as well as future research opportunities.

Literature Review

This section provides the theoretical background, reviews relevant literature and describes the proposed theoretical model and hypotheses for the study of the impact of Web 2.0 use on work-based communication processes and outcomes. We start by highlighting our theoretical orientation and follow this with a description of the literature selected for the review. Next, we review literature on Web 2.0 at Work and the Communicative Ecology Framework (CEF). Lastly, we introduce and discuss the Theoretical Model and Hypotheses.

Theoretical Orientation

The theoretical orientation of our study is the Communicative Ecology Framework (CEF) [13] and the Web 2.0 and organizational communication (W2OC) model [8]. The CEF [13], [14], has been developed in the context of analysing the relationships between different social groups of people, the technologies that they leverage in their communication and the nature of their interactions. Grounded on the CEF, the W2OC model was developed in an exploratory study of Web 2.0 communicative ecology at workplaces in China.

Selection of Literature for the Review

Since we were interested in investigating the work-based communication processes and outcomes of Web 2.0 use in the Chinese workplace, we decided to focus the literature review on Web 2.0 at work and CEF. Specifically, we selected literature on studies of different Web 2.0 tools in the Chinese workplace. We further reviewed the CEF and the W2OC model.

Web 2.0 at Work

Web 2.0 (sometimes known as "social media") exerts an increasing influence on organizational communication processes. In this study, the term Web 2.0 is adopted to denote a continuously growing portfolio of Internet-based technologies and applications that allow individuals to communicate, collaborate, interact and share with specific individuals, groups or social communities, which is in line with the popular usages of the term [15] – [18].

A broad review of the extensive literature on social media is beyond the scope of this paper. Much of the applied research focuses on social contexts, including social activism, disaster response and political campaigns [19], [20]. Research on organizational contexts is more limited, with a focus on microblogging and instant messengers.

Microblogging is noted for its potential to increase the speed and quality of communications, notably in situations characterised by urgency and low bandwidth [20]. It also increases transparency and accountability [21]. Business applications of microblogging include internal and external communication, information sharing, relationship marketing. Yammer, the corporate microblogging application, is used for team-task coordination [22] and e-marketing [23]. Studies of microblogging in China are very limited, but Zhang [24] noted that it is used in viral marketing.

Instant messengers (IM), such as MSN, Skype and G-Talk, have been extensively studied in the Western context for several years, with an extensive literature on the topic. IM users often signal their online status and thus their availability to be contacted [25]. Studies of IM in the Chinese workspace also suggest its popularity and value for enhancing communication [6]. While IM tools have the potential to enhance communication quality and interpersonal connectedness, they may also increase work interruptions, a potential negative consequence [7], [26].

Although the literature is supportive of the value of Web 2.0 for organizations, it is important to note that not all organizations are equally enthusiastic. Davison et al. [1] report that there are considerable corporate concerns, not least with the potential for time wasting and the loss of productivity. Studies in the healthcare industry [10]-[11] posit strong concerns related to privacy and security risks associated with the use of Web 2.0 applications in organizations. Most of these healthcare organizations have established social media policies to control employees' Web 2.0 applications use in order to avoid potential liability issues [11].

Web 2.0 applications, like any other technology, need to be embedded into an appropriate organizational culture that values and leverages them to organizational advantage (cf. [21]). From the theoretical point of view, how Web 2.0 applications facilitate the organizational communication process and subsequently improve performance is under-investigated. In addition, previous Web 2.0 research has seldom focused on studying multiple technologies/media in combination [18]. In order to gain a comprehensive view on the effect of enhancing communication and work performance, we examine the use of Web 2.0 as a mix of multiple communication media.

Communicative Ecology Framework (CEF)

The idea that media and technology influence the way we communicate dates back at least as far as McLuhan [27], though more recent work by Altheide [14] as well as Foth and Hearn

[13] has consolidated earlier arguments and led to the defining of the term communicative ecology as “the context in which communicative processes occur” [13, p.756].

Foth and Hearn [13] conceptualize communicative ecology using a three-layer framework, namely a social layer, a discursive layer and a technological layer. It is important to note that the CEF is a high level framework. It is not a structural or conceptual model. CEF enables researchers to investigate complex real-life situations through the layered ecology metaphor. The social layer includes entities such as individuals, groups, organizations and the social relationships among them. The discursive layer is the discourse or content of the communication. The technological layer includes the technology and media that facilitate the communication process.

Grounded on the concepts of CEF, we depict an extended, four-layer version of the CEF in the context of Web 2.0 in Figure 1. In this extended CEF, the technological layer consists of Web 2.0 applications (the icons indicate some examples) as the communication media. Over time, new Web 2.0 applications may be introduced and old Web 2.0 applications may be retired or phased out. The discursive layer consists of the content of the communication such as discourse, ideas and themes in the information exchange process. The social layer consists of the social environment in which individuals, groups and organizations form different social structures. We separate out individuals as a separate layer since they are the primary agents for any communication, especially in the context of Web 2.0. We also highlight roles and identities, social relationships and culture as key factors in the social layer that significantly influence both the social network, structure and behavior and the individuals’ communication practices.

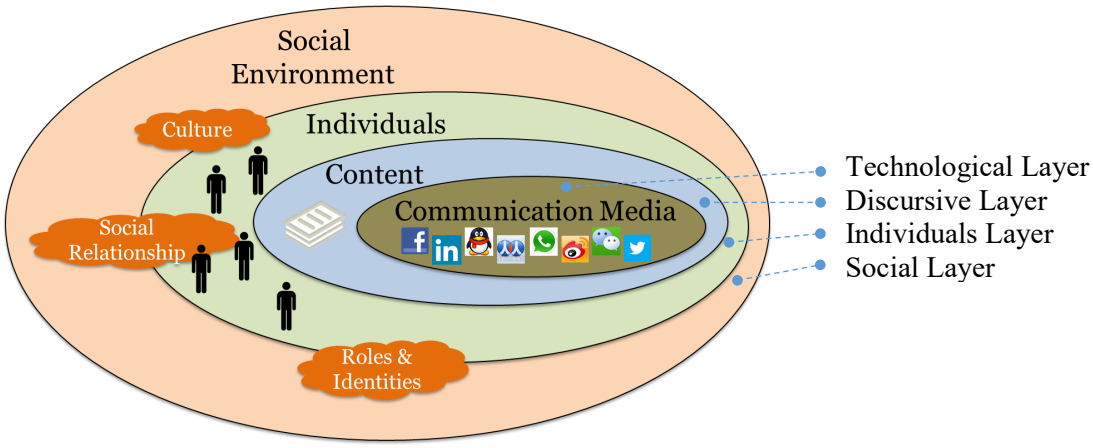

Fig. 1. The Extended CEF

Consistent with Davison et al. [8], we consider the four layers of the framework to be intricately interwoven and mutually constitutive. Therefore, it is not practical to separate out the different technological media being used, the different social contexts in which communication takes place, the different individuals engaged in communication or even the discursive content as all are entangled together. As Tacchi, Slater and Hearn [28, p.17] note, communication requires "processes that involve a mix of media, organized in specific ways, through which people connect with their social networks".

Web 2.0 and Organizational Communication Model (W2OC)

Recently, Davison et al. [8] have applied the CEF as a theoretical lens to conduct an exploratory study analyzing the communicative ecology of Web 2.0 at work. Utilizing the CEF as a scaffold, they conducted their qualitative cross-case analysis of the use of Web 2.0 applications in four Chinese professional-services firms. In summarizing the findings of their study, they inductively developed the W2OC model. The W2OC model consists of propositions (see Appendix B) that explicitly elucidate how the use of Web 2.0 at work enhances communication and performance outcomes. The W2OC model also acknowledges that the degree of communication enhancement is dependent on external factors such as management support and partner's preference for specific communication media. While the

majority of previous studies drawing on the CEF are qualitative (e.g. action research and case studies) and rarely provide detailed propositions suitable for future quantitative research, the W2OC model does provide a foundation for researchers to develop a theoretical model and instrument that could be employed to investigate the entwined relationships among the social, individual, discursive and technological layers in the workplace. Based on this review of the literature and identification of research gaps, we develop our theoretical model and hypotheses in the next sub-section.

The Theoretical Model and Hypotheses

In adapting and extending the CEF [13] and its later instantiation as the W2OC model by Davison et al. [8], we have focused on the primary communication functions where we see Web 2.0 applications providing significant benefits in organizations. The CEF connects the communication media, people and their social environment, as well as the communication content in a rich ecological system. In this system, the interaction between people in networks is facilitated by information and communication technologies.

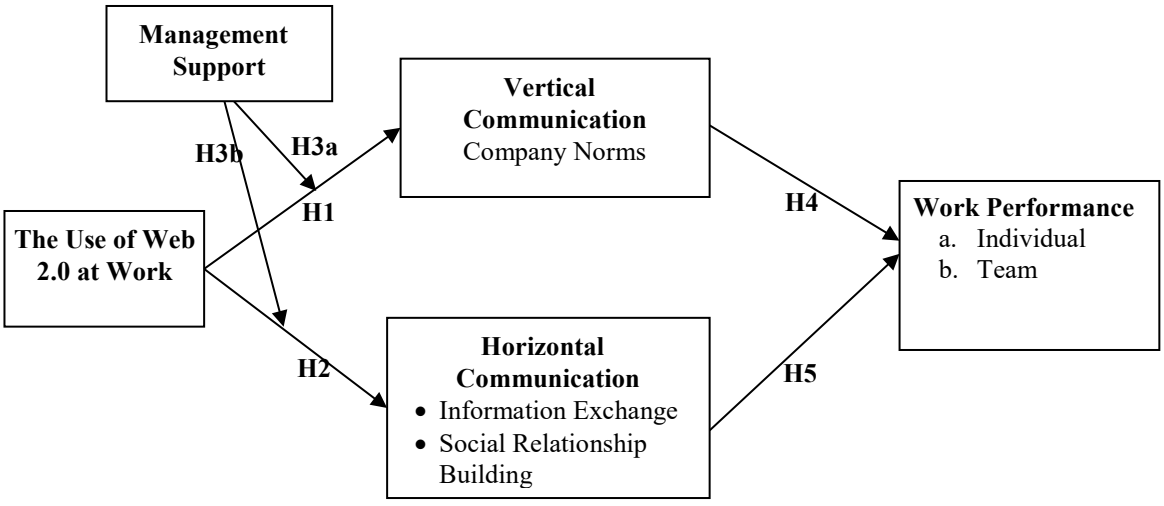

Fig. 2. The Proposed Theoretical Model

The ecological metaphor and research perspective can be applied at either holistic (macro) or individual (micro) levels of analysis. Meanwhile, organizational communication can be classified into two dimensions: vertical and horizontal [29]. The former refers to the information disseminated from senior to junior colleagues, or from a management team down to operational level staff, to establish and maintain corporate strategy and norms [30]; the latter includes peer communication for information and knowledge exchange, as well as social relationship building between colleagues and departments, and with external customers and suppliers [1]. Accordingly, we propose that a mediating role for the different types of communication, vertical and horizontal, is necessary for the use of Web 2.0 applications to exercise their positive influence on performance at both the individual and the team levels, as depicted in Figure 2. The proposed model draws upon the W2OC model and reflects the fundamental concepts in the extended CEF. Specifically, through the propositions of the W2OC model, the intricately interwoven and mutually constitutive relationships between the different layers (social, individuals, discursive and technological) in the CEF are encapsulated into the constructs of the proposed model. In the next few paragraphs, we present arguments to justify this new theoretical model and summarize our discussions into hypotheses.

The Use of Web 2.0 in Facilitating Organizational Communication

Following the explanations in the previous sub-sections, we contend that the use of Web 2.0 applications at work supports many functions including: to stay informed; to share information and knowledge; to connect customers and colleagues; and to achieve learning and training goals [1], [7]. Furthermore, we argue that the use of Web 2.0 at work can facilitate both vertical communication and horizontal communication at work.

From a top-down perspective, the use of Web 2.0 applications (such as blogs, podcasts and prediction markets) can help disseminate corporate strategy and deliver industry information

to the whole company. Participatory Web 2.0 applications facilitate vertical communications such as announcements, information about organizational activities and outcomes. As a result of the frequent dissemination of information and interaction with employees who engage with the use of Web 2.0 applications at work, the company identity can be established and emphasized.

From a bottom-up perspective, Web 2.0 applications can provide a channel that aggregates opinions from individual employees who wish to contribute to strategic planning. Web 2.0 applications then enhance the efficiency of information flow between the top and bottom of the organization. We thus hypothesize that:

H1: The use of Web 2.0 at work is positively associated with vertical communication, specifically for establishing company norms, across an organization.

In the horizontal dimension of organizational communication, Web 2.0 applications, typically IM and blogs, enable mass internal content creation and the broadcasting of solutions across internal departments, as well as different physical locations, as solutions are found to problems. The ease-of-use characteristics of Web 2.0 can also enable external parties to participate in product development, provide feedback and aid in customer support. Many companies, including General Electric, Procter & Gamble, Shell and Airbus, have found that Web 2.0 is valuable for "horizontal collaboration" since it "harnesses the power of collective intelligence to boost productivity, foster innovation and create enhanced value" [31]. The immediacy and the ease of use of Web 2.0 can help integrate customers, suppliers and employees into the communicative ecology by either providing a dialogue forum or facilitating the one-to-one interactive and informal communication that subsequently contributes to the social relationship building. Therefore, we hypothesize that:

H2: The use of Web 2.0 at work is positively associated with horizontal communication, including information sharing and social relationship building, across an organization.

The Moderating Role of Management Support

Management support has long been recognised as critical to the success of information systems implementation [32], [33]. We argue that management support is also critical to determine the positive impacts of informal information systems in communication processes in organizations. Specifically, the influence of the use of Web 2.0 on communication at work is contingent on management support. In a strong management support situation, employees may feel more empowered to use Web 2.0 applications at work, and hence can experience more autonomy in choosing the most effective communication media according to their needs and circumstances. Senior managers can encourage interaction using Web 2.0 applications to break down structural silos within the organization. Thus with managerial support, the use of Web 2.0 at work can be more effective in enhancing both horizontal and vertical communication in organizations. On the other hand, if the senior management opposes the use of Web 2.0 at work, the positive effect on communication will not be so obvious. Accordingly, we hypothesize that

H3: Management support moderates the effects of the use of Web 2.0 at work on vertical communication (H3a) and horizontal communication (H3b), meaning that with stronger management support, the use of Web 2.0 applications has a stronger positive association with vertical and horizontal communication in organizations.

The Impacts of Communication on Improving Work Performance

The need for and the presence of vertical communication channels have long been considered important in an organization [30]. We argue that vertical communications can provide employees with important and updated information about their jobs, organizations, market and industrial environment. A positive communication climate and effective vertical communication are regarded as important means to strengthen employees' recognition and

therefore identification with their organizations, which subsequently contributes to employees' productivity, a team's coherence and an organization's long-term financial performance [34, p.11]. Accordingly, we hypothesize that:

H4: Vertical communication through Web 2.0 technology that is undertaken in order to support company norms is positively associated with individual performance (H4a) and team performance (H4b).

Following previous explanations, horizontal communication in this study includes information exchange and social relationship building that takes place among people irrespective of their hierarchical position in the organization. Horizontal communication can thus occur among team members; employees from different departments; procurement staff and their suppliers; marketing & sales personnel and their customers. With the aid of Web 2.0 technology, open dialogues between different participants in various locations can be easily established to stimulate interactions between employees and external parties like suppliers and customers. These interactions are valuable because they provide relevant information and capture participants' insights and issues in a timely manner. The information shared inside an organization is critical for understanding, learning, clarifying ambiguity, conflict resolution and productive teamwork, while social relationships are established as interaction occurs. Researchers (e.g., [7], [8]) have found that effective communication, supported by Web 2.0 technologies, can facilitate the building of trust, a critical ingredient not only in work and social relationships, but also in successful team collaboration. Accordingly, we hypothesize that:

H5: Horizontal communication through Web 2.0 technology, covering information exchange and social relationship building, is positively associated with individual performance (H5a) and team performance (H5b).

We integrate the above hypotheses into the theoretical model (as shown in Figure 2). Age, gender and education were included as the control variables.

Methodology

This section describes the methodology of the study. We first explain our choice of research methodology. Then we describe the participants of the study, measures of the variables and the details of data collection. Subsequently, we describe the data analysis and details for ensuring validity and reliability.

Choice of a Research Methodology

We chose to use a quantitative methodology to extend the perspective of W2OC model and complement previous CEF based qualitative research. We employ a survey method to verify the research model. A survey has the benefit of reaching respondents in the field who are representative of the larger and wider target population. We can then potentially generalize the results.

Participants

The participants were working professionals in China. Institutional review board approval was obtained prior to conducting the survey. In order to identify respondents, we used a customer panel database provided by a marketing research firm in China. In this database, we randomly selected and sent out an online survey hyperlink to 3000 panel members who were registered as employees. We indicated that RMB30 (approximately US$5) would be provided as a token of appreciation for each respondent on the first page of the online survey.

How Data Was Collected

This sub-section describes the details of the data collection process of our study. There are two parts regarding the details of the Measures, namely Instrument, which explains the development and validation of measures, followed by Process for Administering the Instrument, which describes the data collection procedure.

Measures

Instrument

We use existing measures from the literature to form the items used in this study. The independent variable, the use of Web 2.0 at work, is operationalized based on Ou and Davison's [7] measure of IM usage at work as well as Olasina's [35, p.31] measure of "the use of Web 2.0 tools and social networking sites by librarians". We extended their measures into the context of using Web 2.0 applications in organizational workplaces. Regarding vertical communication for establishing company norms, the measures are adapted based on Lewis, Wright and Geroy's [36] items about maintaining corporate norms. We operationalize horizontal communication as a second-level construct that covers information exchange and social relationship building. Information exchange as the first-level construct is measured based on Phang, Kankanhalli and Sabherwal's [37] items of knowledge seeking and contribution through online community systems. We adapted their measures into the general context of information exchange in an organization. For social relationship building, we made use of Ou and Davison's [7] scale of social relationships. We adapted items from Jarvenpaa and Ives [32] for the moderating variable, management support. With respect to performance, we separate it into two distinct dependent variables that cover individual and team levels. Specifically, the items of individual and team performance were adapted based on the scales developed by Rice [38]. Appendix A provides a complete list of the items.

Process for Administering the Instrument

As the items were established based on the existing literature in English, we followed the guidance of Van de Vijver and Leung [39] for translating items into Chinese. Accordingly, a professional translator, who has no relationship with our research project, was hired to translate the Chinese questionnaire back to English. During the consistency checking process, we found no semantic discrepancies between the retranslated questionnaire and the original English items. Furthermore, we also invited 10 working professionals in China to review and critique the measurement items in order to ensure their content validity before the actual data collection process. We collected survey data using Qualtrics, a professional survey website. An online survey hyperlink was sent to the randomly selected participants.

How Data Was Analyzed

This sub-section describes the details of the data analysis process of our study. We used the Partial Least Squares (PLS) Structural Equation Modeling (SEM) for analyzing the proposed theoretical model [40]. In the Measurement Model sub-sub-section, we explain how we examined the validity and reliability of the measures used in this study. Then, we explain how we examined the structural model for hypothesis testing in the Research Model sub-sub-section.

Assuring Reliability and Validity

The Measurement Model

We used the Statistical Package for the Social Sciences (SPSS) and Smart Partial Least Squares (SPLS) to examine the validity and reliability of the measures used in this study. The exploratory factor analysis results obtained through SPSS first confirmed the convergent and discriminant validity of those reflectively measured first-order constructs. Specifically, all the

factor loading scores on their expected factors are above 0.69. Furthermore, the own factor loading scores are higher than the cross-loading scores. Meanwhile, the eigenvalues of the constructs are all higher than 1.0, with the communality scores above 0.70. As explained in the methodology section, we operationalize horizontal communication as a second-order construct formatively measured by information exchange and social relationship building. We used the factor scores of these two first-level constructs as the composite dimensions of horizontal communication into the SPLS analysis of the whole research model, following the method of handling second-order constructs in SPLS suggested by Petter, Straub and Rai [41]. As shown in Figure 3, the loading of each composite dimension of horizontal communication was significant. In addition, we also examine construct reliability for all principal constructs with reflective measures by identifying the composite reliability scores, all of which are above 0.90 (as shown in Table II), suggesting acceptable internal consistency. The square roots of the Average Variance Extracted (AVE) are all above 0.84, which is greater than all other cross correlations. This shows that all constructs capture more construct-related variance than error variance. Taken together, these results demonstrate adequate convergent and discriminant validity for all constructs used in this study.

Table II

Descriptive Statistics, Correlation Matrix, and Average Variance Extracted.

Correlation Matrix	**UOW2**	**CN**	**MS**	**IE**	**SRD**	**IP**	**TP**
UOW2: The Use of Web 2.0	-						
CN: Company Norm	0.35	**0.84**					
MS: Management Support	0.30	0.36	**0.84**				
IE: Information Exchange	0.29	0.43	0.16	**0.91**			
SRD: Social Relationship Building	0.41	0.60	0.17	0.61	**0.94**		
IP: Individual Performance	0.36	0.45	0.26	0.54	0.65	**0.92**	
TP: Team Performance	0.41	0.54	0.28	0.55	0.71	0.78	**0.94**
Mean	-	4.97	4.50	4.35	4.97	5.12	5.17
STD	-	1.84	2.37	1.81	1.70	1.71	1.71
Composite Reliability	-	0.90	0.90	0.95	0.98	0.96	0.97
Cronbach's Alpha	-	0.86	0.86	0.93	0.97	0.94	0.96

Note: The Use of Web 2.0 was measured formatively. Its mean, standard deviation, average variance extracted (AVE), composite reliability and Cronbach's alphas are not relevant for measuring its construct validity. Diagonal elements above the "mean" row are the square root of AVEs from their indicators. Off-diagonal elements above the "mean" row are correlations between constructs.

Considering that all the data were collected from a single source, we also tested common method bias. First, our principal components factor analysis indicated that each factor explains roughly equal variance. Second, our correction matrix shows that the highest inter-construct correlations are below 0.78, while common method bias is usually evidenced by extremely high (r=0.90) inter-construct correlations [42]. These tests indicate that common method bias is not a major concern for the current study.

The Research Model

After verifying the measurement model, we then examined the whole structural model in SPLS. Specifically, we created the structural model in SPLS and implemented the PLS algorithm for model estimation to obtain explained variance measures and path coefficients. We also conducted a bootstrapping procedure using 5,000 bootstrap samples to determine the statistical significance of the path coefficients [40].

Results

This section presents the results of the study. It is organized into three sub-sections: Who Participated in the Study, Analyzing the Research Model and Results of Testing for Hypothesis.

Who Participated in the Study

Over a two month period we successfully reached 2873 email addresses. After removing invalid responses and those with either too little or too much time spent completing the online survey, we finally obtained 179 valid responses, yielding a response rate of 6%. We

examined non-response bias using the method described by Armstrong and Overton [44]. Specifically, we conducted a Mann-Whitney test of the demographic characteristics of respondents in the first month and in the second month and found that they did not significantly differ ($p>0.10$). Therefore these 179 data points formed the data set for subsequent statistical analysis. We summarize the demographic characteristics of these 179 survey respondents in Table I.

TABLE I

Demographic Characteristics (n=179)

Gender	%	Age Range	%	Industry Type	%
Male	47	25 or below	58	Agriculture/forestry/fishery/mining	6
Female	53	26–35	31	Construction	8
		36–45	9	Culture, sports, and entertainment	4
		46 and above	2	Electric power, gas, and water production and supply	4
				Financial intermediation	7
				Manufacturing	7
				Hotels and catering services	2
				Information transfer, computer services, and software	18
				International organization	3
				Real estate	3
				Transport, storage and post	4
				Wholesale and retail trades	7
				Others	27
Education Level			**%**	**Position**	**%**
High school or below			28	Non-Management Employee	57
College			28	Manager	15
Undergraduate			35	Senior or Executive Manager	7
Master or above			8	Undisclosed	21

Analyzing the Research Model

After verifying the measurement model, we then examined the whole structural model in SPLS. The results in Figure 3 suggest the research model is largely supported by the data, except hypotheses H3a, H3b and H4a. Specifically, the use of Web 2.0 at work is significantly associated with both vertical communication ($b=0.27$, $p<0.01$) and horizontal communication ($b=0.39$, $p<0.01$) in organizations, with the explained variance of 20% and

17%, respectively, thus validating H1 and H2. Although the moderating effect of management support in the research model was not confirmed, our data indicate management support is positively related to vertical communication at work (b=0.28, p<0.01). Vertical communication is found to be significantly associated with team performance (b=0.18, p<0.01) but not individual performance (b=0.07, p>0.10), therefore supporting H4b but rejecting H4a. Our data indicate that horizontal communication has strong direct effects on individual performance (b=0.64, p<0.01) and team performance (b=0.62, p<0.01). Together with vertical communication, horizontal communication explains substantial amounts of variance of individual performance (R^2=46%) and team performance (R^2=54%). Besides, none of the control variables (age, gender and education) has a significant effect. The R^2 scores for all dependent variables in this study, together with the factor loadings, yield an excellent goodness-of-fit for the whole research model [43].

In addition to the proposed research model, we also conducted an additional test for the direct path from the use of Web 2.0 at work to the two performance constructs. However, our analysis indicates that none of the two direct paths are significant. We discuss the implications of these findings in the conclusion section.

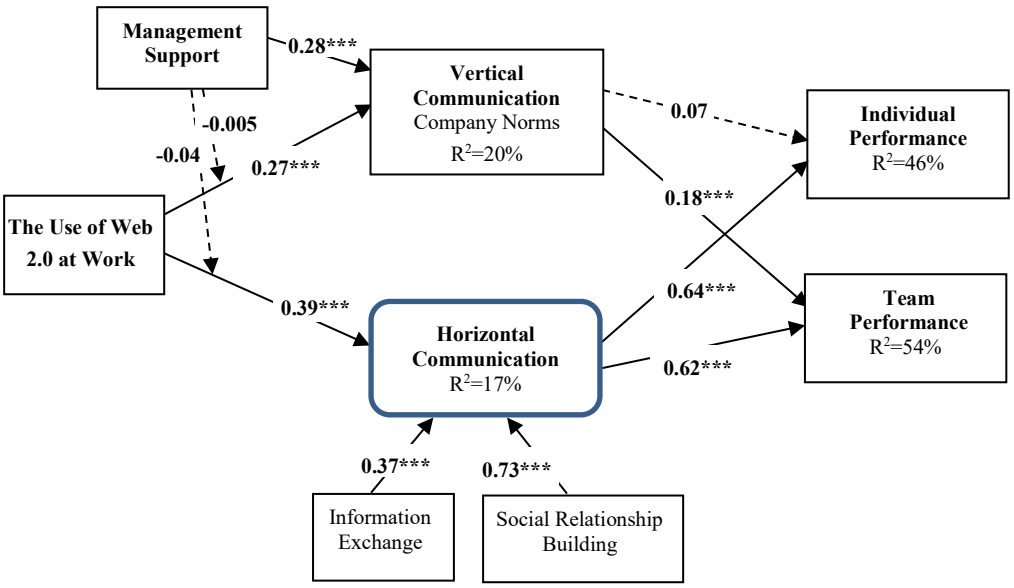

Fig. 3. SPLS Results

Note: Square boxes represent the first-order constructs. Bevels represent second order construct (Horizontal Communication) formatively measured by two first-order constructs (Information Exchange and Social Relationship Building). Paths in solid lines are significant links (*0.05<p<0.10; **0.01<p<0.05; ***p<0.01). Paths in dotted lines are insignificant links.

Results of Testing for Hypothesis

Results of Testing for H1: The use of Web 2.0 at work is positively associated with vertical communication, specifically for establishing company norms, across an organization.

Based on the SPLS results of the structural model analysis, the use of Web 2.0 at work was significantly associated with vertical communication (b=0.27, p<0.01) in organizations, with the explained variance of 20%. Thus, H1 is supported.

Results of Testing for H2: The use of Web 2.0 at work is positively associated with horizontal communication, including information sharing and social relationship building, across an organization.

Based on the SPLS results of the structural model analysis, the use of Web 2.0 at work was significantly positively associated with horizontal communication ($b=0.39$, $p<0.01$) in organizations, with the explained variance of 17%. Therefore, H2 is supported.

Results of Testing for H3: Management support moderates the effects of the use of Web 2.0 at work on vertical communication (H3a) and horizontal communication (H3b), meaning that with stronger management support, the use of Web 2.0 applications has a stronger positive association with vertical and horizontal communication in organizations.

Based on the SPLS results of the structural model analysis, the moderating effect of management support was not supported. Hence, H3a and H3b are rejected. However, our data indicates that management support is positively related to vertical communication at work ($b=0.28$, $p<0.01$).

Results of Testing for H4: Vertical communication that uses Web 2.0 technology that is undertaken in order to support company norms is positively associated with individual performance (H4a) and team performance (H4b).

Based on the SPLS results of the structural model analysis, vertical communication was significantly positively associated with team performance ($b=0.18$, $p<0.01$) but not individual performance ($b=0.07$, $p>0.10$). Therefore, H4a is rejected but H4b is supported.

Results of Testing for H5: Horizontal communication that is undertaken with Web 2.0 technology, covering information exchange and social relationship building, is positively associated with individual performance (H5a) and team performance (H5b).

Based on the SPLS results of the structural model analysis, horizontal communication had strong direct effects on individual performance ($b=0.64$, $p<0.01$) and team performance ($b=0.62$, $p<0.01$). Hence, both H5a and H5b are supported.

Conclusions, Limitations and Suggestions for Future Research

This section discusses implications and limitations of our study and provides suggestions for future research. This section starts with Conclusions, followed by Limitations and finally Suggestions for Future Research.

Conclusions

This research has several key findings and implications. We discuss how practitioners can leverage our findings regarding the use of Web 2.0 at work in the Implications for Practice sub-section. We further discuss the theoretical contribution of our study in the Implications for Research and Theory sub-section.

Implications for Practice

Our data analyses show that management support has no moderating effect on the use of Web 2.0 at work in the Chinese context for either vertical or horizontal communication. It is plausible that the ubiquity of Web 2.0 applications and the convenience they bring to employees overwhelm the effect of management support. This is particularly true for the impact on horizontal communication, which is often very strong in the Chinese context [2]-[8]. In contrast, management support does have a direct effect on vertical communication. Together with the use of Web 2.0 at work, management support has a significantly positive

relationship with vertical communication, with an explained variance of 20%. This implies senior management can leverage the use of Web 2.0 applications, such as blogs or IM, to establish company norms.

Interestingly, our data analyses indicate that vertical communication had a weaker relationship than did horizontal communication with performance. This reflects how contemporary horizontal communication patterns in the Chinese context, including information and knowledge exchange, as well as social relationship building, have become the cornerstone for organizations to undertake tasks and run a business at different levels. However, further assessment of these communication patterns in different cultural contexts is called for. We provide empirical evidence for how Web 2.0 enables Chinese organizations to reach out to collaborators and business partners, thereby boosting individual productivity and team collaboration. Our study also highlights the fit between Web 2.0 and the need for organizational horizontal communication in this era of knowledge, information and creativity. This may directly contradict former organizational culture preferences for controlling and centralizing organizational information. Since our study confirms that there is a strong association between the use of Web 2.0 with higher levels of performance in the Chinese context, we suggest that practitioners should not ignore the instrumental value of Web 2.0 in harnessing and managing personal and public information exchange.

However, it is also worth noting that the effect of using Web 2.0 on performance is not an automatic process. Our mediation test of communication between the use of Web 2.0 and performance suggests that the direct impact of using Web 2.0 on both individual and team performance is not significant: the mere presence of Web 2.0 guarantees nothing. Nevertheless, encouraging employees to participate in Web 2.0 based interactions may help enhance team outcomes and thus stimulate organizations to consider how they can engage with employees directly in order to achieve these performance gains.

Implications for Research and Theory

Building on the CEF [13] and W2OC model [8], we have conceptualized the communication processes in organizations as involving vertical and horizontal elements that can be enhanced with Web 2.0 applications. We also quantify both the benefits of using Web 2.0 applications and the subsequent communication processes for organizations. Our data suggest that vertical and horizontal communication contribute to individual and team performance significantly, with explained variances of 46% and 54% respectively. Such high scores testify to the substantial contribution of communication in the levels of operation in an organization, including individual tasks, teamwork and business processes.

Limitations

In addition to the above theoretical and practical implications, this research has several limitations that suggest future research opportunities. First, although this research was specifically designed for the Chinese context, it would be valuable to verify the research model in different cultural contexts, including local contextual characteristics as either independent variables or moderators. Second, we collected subjective data from survey participants. Objective performance data could usefully supplement the subjective data with additional measures. Thirdly, a large proportion of survey participants were from the information transfer, computer services and software industry; the findings might hold less true for other industries. Finally, longitudinal data would permit the examination of the impacts of Web 2.0 on different tasks and projects over time.

Suggestions for Future Research

Social media is here to stay, in both personal and organizational contexts. We now need to find how to leverage it effectively so as to drive performance benefits, at the individual and team levels. This study represents a step in this direction, but we anticipate further investigations in different cultural contexts will identify new constructs. Ultimately, we need

to engage in careful theorization of the relationships between constructs testing the theory across a wider range of populations.

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Appendix A

Measurement Items

Construct	Item	Source
The Use of Web 2.0 for Work (Formative)	How frequently do you use Web 2.0 for the following purposes at work? (scale 1:Never; 7: Always) (a) Information seeking (b) Information sharing (c) To stay well informed (d) Office communication (e) File sharing (f) Information dissemination (g) Learning and training (h) Public relations (i) Marketing	[4], [30]
Vertical Communication	• My organization has identified organizational norms. • My organization has established organizational norms. • My organization's norms are evolving.	[31]

		• The digital economy influences my organization's norms.	
Horizontal Communication (Second order formative)			
	Information Exchange	• I frequently exchange information with my network members who are inside the organization. • I regularly exchange information with my network members who are inside the organization. • I frequently exchange information with my network members who are outside the organization. • I regularly exchange information with my network members who are outside the organization.	[32]
	Social Relationship Building	• I have developed a good social relationship network with my colleagues in the organization. • I have developed a good social relationship network with my organization's external business partners. • I have developed a good social relationship network outside my organization. • I have many good work-related contacts with my colleagues in the organization. • I have many good work-related contacts with my organization's external business partners. • I have many good work-related contacts outside my organization.	[4]
Management Support		• The management of my organization supports the use of Web 2.0 by employees in the organization. • The management of my organization's perception of Web 2.0's importance to the organization. (scale 1: not important at all; 7: extremely important) • Web 2.0 plays a technical role in the organization. • The management of my organization endorses the use of Web 2.0 applications in the organization.	[27]
Individual Performance		• I am confident when undertaking my work. • I am a productive worker. • I am an effective decision maker. • My work quality is high.	[33]
Team Performance		• My team is confident when undertaking teamwork. • My team is made up of productive workers. • My team makes effective decisions.	[33]

	• My teamwork quality is high.	

Note: All the items were anchored on a scale from strongly disagree (1) to strongly agree (7), unless otherwise noted.

Appendix B

Propositions in W2OC Model [8]

	Propositions
1.	The use of Web 2.0 applications can enhance vertical communication in organizations with internal and external stakeholders, thereby establishing and strengthening corporate norms.
2.	The use of Web 2.0 applications can enhance horizontal communication for a variety of purposes related to (a) internal communication: problem solving, knowledge exchange, and social relationship; and (b) external communication: marketing, thought leadership, recruiting, brand management, and after sales service
3.	The effects of Web 2.0 applications on enhancing vertical and horizontal communication are contingent on (a) management support and (b) the media preferences of partners, suggesting their moderating role in Web 2.0-supported communication processes.
4.	The vertical communication of corporate norms will exert a positive influence on work-related processes at the corporate, team, and individual levels.
5.	The engagement in such horizontal communication activities as knowledge exchange, digital marketing, and social-relationship building will exert a positive influence on work-related processes at the corporate, team, and individual levels.