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Exploring employee perceptions of Web 2.0 virtual communities from the perspective of knowledge sharing

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Abstract

Purpose—With the development of Web 2.0 virtual communities, we see a useful platform for knowledge sharing. However, knowledge sharing in virtual communities still remains a big challenge given the concern of knowledge quantity and quality. This study aims to explore the effect of individual differences on knowledge contributing, knowledge seeking, trust and norm of reciprocity. This study also explores the mean difference between knowledge seeking and knowledge contributing as well as the correlations between knowledge seeking, knowledge contributing, trust and reciprocity so as to provide some guidance for knowledge management practice in China.

Design/methodology/approach—Data collected from 430 users of Web 2.0 virtual communities were used for data analysis. The independent samples t test, one-way Analysis of Variance (ANOVA), paired samples t test and correlation analysis were employed.

Findings—The independent samples t test and one-way ANOVA present the effect of individual differences on knowledge contributing, knowledge seeking, trust and norm of reciprocity. The paired samples t test suggests that employees are more likely to seek knowledge from than contribute knowledge to Web 2.0 virtual communities. The correlation analysis suggests there are positive correlations between knowledge contributing, knowledge seeking, trust and reciprocity.

Practical implications—Knowledge management initiatives in Chinese organizations are encountered relatively less frequently, compared with Western countries. We suggest the findings of this study provide useful insights into the informal knowledge sharing in Web 2.0 virtual communities, which is helpful for guiding knowledge management practice in China.

Originality/value—Based on knowledge quantity and knowledge quality whose significance cannot be over-emphasized in virtual communities, this study explores employee perceptions of Web 2.0 virtual communities from the perspective of knowledge sharing, which we think provides a new view for knowledge sharing research and practice alike in China.

Keywords Virtual communities, Knowledge contributing, Knowledge seeking, Trust, China

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Introduction

The term Web 2.0 emerged in 2004, and since then, has provided “a useful, if imperfect, conceptual umbrella” for the formation of the ‘participatory Web’ as we know it today (Madden and Fox, 2006, p. 1). Web 2.0 reflects the shift from a simple website and a search engine where users can only seek information and knowledge to a shared networking space where users can not only seek but also contribute information and knowledge in their work, research, education, entertainment and social activities (Ram *et al.*, 2011). Web 2.0 relies on users’ participation, taking advantage of the wisdom of crowds (Fichman, 2011). Generally speaking, Web 2.0 is “of the user, by the user, and more importantly, for the user” (Chu and Xu, 2009, p.717). Web 2.0 applications include blogs, microblogs, wikis, social tagging, and many others (Mahmood and Richardson, 2011). Web 2.0 applications and the virtual communities formed by them exert extensive and important influences on human society. Since the basic premise of Web 2.0 is that people are encouraged to participate in the shared creation of content, with knowledge seeking and contributing being major activities, so it can be regarded as an efficient knowledge management tool (Yu *et al.*, 2010; Chai *et al.*, 2011; Li *et al.*, 2012).

As important instances of Web 2.0 applications, virtual communities refer to “online social networks in which people with common interests, goals, or practices interact to share information and knowledge, and engage in social interactions” (Chiu *et al.*, 2006, p.1873). In virtual communities, people typically do not know one another and do not expect to meet face-to face in the future. People converge in virtual communities due to their common interests, goals, or practices. Obviously, this context sharply contrasts with traditional communities where people typically know one another and thus having high expectations of obligation and reciprocity (Wasko and Faraj, 2005). This study focuses on Web 2.0 virtual communities in China, where there are many popular virtual communities such as Baidu Know, Baidu Document, ScienceNet Blog, Sina Microblog, Chinese Wikipedia, Renren Network, each of which attracts millions of users.

Knowledge sharing can provide organizations with sustainable competitive advantages (Huang *et al.*, 2011), but it is impossible for most organizations to possess all the required knowledge within their formal boundaries (Wasko and Faraj, 2005). With the development of Web 2.0 applications, we see a useful platform for knowledge sharing. Indeed, using virtual communities such as social network sites is not for fun (Xu *et al.*, 2012); a virtual community creates a virtual space where individuals congregate to form a community for activities such as knowledge exchange and sharing (Liao and Chou, 2012); sharing knowledge is just an important aspect of being a member of a virtual technological community (Bouty, 2000); and “many individuals participate in virtual communities, for seeking knowledge to resolve problems at work” (Chiu *et al.*, 2006, p. 1872). However, knowledge sharing in virtual communities still remains a big challenge given the concern of knowledge quantity and quality. On the one hand, knowledge contributing which is critical for knowledge quantity has long been identified as a bottleneck since users of virtual communities tend to believe that their contributing would not be worth the effort and time (Yan and Davison, 2013). On the other hand, knowledge quality is difficult to guarantee given the traditional gate-keeping on the knowledge production side seems

to disappear and “more and more of the available content is obtained from sources with mixed, and sometimes dubious, provenance” (Arazy and Kopak, 2011, p. 89).

Trust is likely to be salient in virtual communities where “there is no concrete reward system in place to reinforce the mechanisms of mutual trust, interaction, and reciprocity among individuals” (Chiu *et al.*, 2006, p. 1876). Trust refers to the degree of willingness of a party to be vulnerable to the actions of another party (Mayer *et al.*, 1995). Trust was much studied with a party as an institution, an individual or an information system (Li *et al.*, 2008). Generally, trust can be categorized into two types, i.e., relationship-based trust and institution-based trust (Ardichvili, 2008). This study focuses on relationship-based trust which is suggested to be necessary for creativity (Tierney *et al.*, 1999) and knowledge quality which is defined as the quality of the content of shared knowledge, concerning relevance, ease of understanding, accuracy, completeness, reliability, and timeliness (Chiu *et al.*, 2006). The characteristics of virtual communities such as the lack of face-to-face contact may hinder relationship-based trust development (Ridings *et al.*, 2002). In this situation, we suggest it is useful to examine trust in the context of knowledge sharing given “trust is developed through repeated interactions with time” (Hsu *et al.*, 2007, p. 157). Indeed, knowledge seeking and knowledge contributing in Web 2.0 virtual communities reflect a kind of repeated interactions among users with time given what one user seeks is just what other users contribute.

Inspired by knowledge quantity and quality issues in virtual communities, this study explores the effect of individual differences on knowledge seeking, knowledge contributing, trust and reciprocity given individual differences determine how individuals think and behave in different ways (Aharony, 2013; Nov and Ye, 2008). This study also explores the mean difference between knowledge seeking and knowledge contributing as well as the correlations between knowledge seeking, knowledge contributing, trust and reciprocity. We suggest this study provides a new view for knowledge sharing research and practice alike in China. Following this introduction, we review the literature, paying attention to knowledge sharing and trust. We follow this with a description of the research methodology and data collection. Then, we present the results of the research and a discussion of these results.

Literature review

Knowledge sharing and Web 2.0 virtual communities

Knowledge is personalized information possessed in the mind of individuals which is related to “facts, procedures, concepts, interpretations, ideas, observations, and judgments” (Alavi and Leidner, 2001, p. 109). Knowledge has long been a focus of research since knowledge represents the most valuable resources of organizations, such as operational routines, creative processes and intangible assets that are unlikely to be transferred to or shared with others through a simple copying process (Wasko and Faraj, 2005; Yan and Davison, 2013). Consequently, simply making knowledge repositories or knowledge management systems (KMS) available cannot guarantee successful knowledge sharing activities (Watson and Hewett, 2006). It was estimated that “at least US\$31.5 billion are lost per year by Fortune 500 companies as a result of failing to share knowledge”, even though organizations have ploughed tremendous energy and investment into the development of KMS so as to facilitate the collection, storage, and distribution of knowledge inside the boundary of the organization (Wang and Noe, 2010, p. 115).

Knowledge sharing reflects knowledge exchange among individuals given what one seeks is just what others contribute. The essence of knowledge sharing lies in facilitating knowledge creation (Huang *et al.*, 2008). In this sense, knowledge contributing and knowledge seeking demonstrate two distinct types of behavior, yet both are closely related with each other and both must occur for the presumed benefits of knowledge sharing to be realized (He and Wei, 2009). In the organizational context, knowledge contributing refers to the codification and storage of individuals' knowledge into knowledge repositories or KMS such that other individuals within the firm can access and reuse it; while knowledge seeking usually means individuals seek and use knowledge contributed by a different individual or group within the same firm so as to enhance their work performance (Watson and Hewett, 2006).

In organizational contexts, many Chinese employees hold a strong belief that knowledge contributing means losing knowledge power. In the Chinese business culture, information and knowledge are seen as key sources of power and personal power is maintained by carefully controlling key information and knowledge. Fundamentally, information and knowledge are treated as personal assets rather than organizational resources (Martinsons and Westwood, 1997). Indeed, contributing knowledge is least likely to be natural since people tend to think their knowledge is valuable and important. And hoarding knowledge on the one hand and being suspicious upon knowledge from others on the other hand have formed the natural tendency (Hsu *et al.*, 2007). Consequently, knowledge sharing activities often encounter challenges and may eventually fail in Chinese organizations (Huang *et al.*, 2011). With the development of Web 2.0 applications, we suggest that Web 2.0 virtual communities provide informal yet efficient platforms for knowledge sharing activity where employees can exchange knowledge with outside people who share common interests, goals, needs or practices with them, compared with the formal (and expensive) KMS used or expected to be used inside organizations.

During our visits to popular Chinese Web 2.0 virtual communities, we saw hundreds of types of knowledge seeking and contributing activities occurring. Typical topics included but are not limited to: technological know-how; marketing know-how; purchasing know-how; knowledge about financial resources; knowledge about sales and marketing; knowledge about knowledge management. For example, what good knowledge management tools can be recommended? What methods are there for customer management? What methods are there for competitor analysis? In Web 2.0 virtual communities, mass production and dissemination of information have become faster and easier than ever before (Lu and Yuan, 2011), which increasingly impacts how people seek information they need (Fallis, 2008). In this situation, many studies have explored semantic techniques so as to analyze information. Deerwester *et al.* (1990) described a new approach to automatic indexing and retrieval, where it was suggested that there is some underlying latent semantic structure in information and statistical techniques can be used to estimate this latent structure. Toral *et al.* (2010) identified 13 paradigms in the field of intelligent transportation systems by semantically analyzing relevant studies. Many other studies have also reported semantic techniques, taking as their focus the construction of a semantic network by using the semantic information extracted from comment content (Xia and Bu, 2012), the semantic social media analytics (Barbieri *et al.*, 2010), the object-oriented model of semantic social networks (Schatten, 2013), the semantic security against web application attacks (Razzaq *et al.*, 2014). In the current study, we explore employee perceptions of Web 2.0 virtual communities from the perspective of knowledge sharing, based on knowledge quantity and knowledge quality whose

significance cannot be over-emphasized in virtual communities.

The basic premise of Web 2.0 is that people are encouraged to participate in the shared creation of content, with knowledge seeking and contributing being major activities. Knowledge exchange and sharing in Web 2.0 virtual communities where users typically do not know one another or do not necessarily expect to meet face-to-face, exhibit significant differences from more traditional communities of practice or contexts where knowledge is exchanged between people who know each other on a continuous basis (Wasko and Faraj, 2005). With these forms of knowledge exchange, organizational members benefit from gaining access to new information, ideas and expertise that are not available locally, and “can interact informally, free from the constraints of hierarchy and local rules” (Wasko and Faraj, 2005, p. 36). In this study, Web 2.0 usage for knowledge seeking (contributing) is defined as the actual usage of Web 2.0 for knowledge seeking or knowledge contributing with respect to the frequency of use and the amount of time involved (Venkatesh *et al.*, 2003; Kankanhalli *et al.*, 2005).

Trust and reciprocity

Trust and reciprocity are critical in Web 2.0 virtual communities (Chai and Kim, 2010; Chai *et al.*, 2011; Hsu *et al.*, 2007; Shu and Chuang, 2011) given the absence of workable rules in this context makes reliance on trust essential and necessary for the continuity of the virtual community (Ridings *et al.*, 2002). Trust is a multi-faceted concept that has been much studied across many disciplines (Li *et al.*, 2008). In this study, we adopt Mayer *et al.*'s definition of trust: “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” (Mayer *et al.*, 1995, p. 712). Trust has been viewed as a set of specific beliefs dealing primarily with different components such as integrity, benevolence, and ability of another party (Li *et al.*, 2008). Generally, “trust develops when a history of favorable past interactions leads to expectations about positive future interactions” (Wasko and Faraj, 2005, p. 43). In this study, trust refers to relationship-based trust among users regarding integrity and benevolence (He and Wei, 2009).

Grasswick (2010) suggests it is important to share appropriate knowledge so as to earn and maintain trust. This study explores trust in the context of knowledge sharing. In this respect, trust is to some extent related to social exchange theory (SET). SET proposed that exchange between people is a fundamental form of behavior and is always based on the principles of cost and benefit (Cyr and Choo, 2010). However, unlike economic exchange, no concrete roles or contracts accompany social exchange in which people's gain is not as certain as that in economic exchange even though it is also based on what they give (Huang *et al.*, 2008).

In social exchange, anticipated reciprocal relationship was suggested as an important aspect of benefit and was believed to be critical in the formation of trust (Suh and Shin, 2010). The basic norm of reciprocity relates to “a sense of mutual indebtedness, so that individuals usually reciprocate the benefits they receive from others, ensuring ongoing supportive exchanges” (Wasko and Faraj, 2005, p. 43). Offline norm of reciprocity tends to persist in the online virtual community (Chai *et al.*, 2011). In a virtual community, reciprocity is defined as “the benefit expectancy of a future request for knowledge being met as a result of the current contribution” (He and Wei, 2009, p. 828). In this study, norm of reciprocity refers to “knowledge exchanges that are mutual and perceived by the parties as fair” (Chiu *et al.*, 2006, p. 1877). Norm of reciprocity reflects a shared belief among users of virtual communities that “individual members will

reciprocate the benefits received from others, ensuring ongoing contributions to the group” (Suh and Shin, 2010, p. 448).

Method and data collection

Research questions

This study investigates the following specific research questions.

RQ1: Do different employees have different perceptions of Web 2.0 virtual communities in terms of Web 2.0 usage for knowledge contributing (USAKC), Web 2.0 usage for knowledge seeking (USAKS), trust (TRU) and norm of reciprocity (NRECI)?

RQ2: Do employees contribute more or seek more in Web 2.0 virtual communities?

RQ3: Are there any correlations among knowledge contributing, knowledge seeking, trust and norm of reciprocity?

Measures development

This study examines four constructs (latent variables). All the constructs and the corresponding measurement items were adapted from the previous literature to fit the context of this study. Specifically, the items measuring Web 2.0 usage for knowledge seeking and Web 2.0 usage for knowledge contributing were adapted from Kankanhalli *et al.* (2005) and Venkatesh *et al.* (2003); the items measuring norm of reciprocity were adapted from Chiu *et al.* (2006); the items measuring trust were adapted from He and Wei (2009). The complete instrument can be found in the Appendix. All the items were measured with a 7-point disagree-agree Likert scale.

Data collection

We developed a survey instrument. We first collected pilot data from current Web 2.0 users in China (40 usable questionnaires). We also had the opportunity to interact with some of these respondents when they experienced problems completing the survey. Based on the feedback received from the pilot survey, we adjusted wordings in several items. We then conducted a large scale survey.

This study targeted employees in organizations who are also users of Web 2.0 virtual communities. Drawing on alumni from two Chinese universities, we attempted to locate organizations that would be willing to participate in the research. We contacted organizations through email and telephone and invited them to participate in the survey. We finally obtained consent to participate from 14 organizations which included universities, research institutes and enterprises. In each of these organizations, employees were randomly invited to participate in the survey. Data collection was undertaken on a voluntary basis through printed paper questionnaires or an online survey website according to respondents' preference. This process lasted for 6 weeks. The average response rate across different organisations was approximately 60%. 232 valid questionnaires in printed form were received and 198 valid questionnaires were completed online in this fashion. In line with the prevailing practice by Churchill Jr. (1979) and Ramamurthy *et al.* (2008) regarding the test of response bias, we conducted analysis for any differences on key demographics between the early and late respondents. Specifically, we employed nonparametric tests to compare the difference of key demographics of early 10% and late 10% of print and online survey. According to the comparison, no significant differences existed in gender ($\chi^2=1.152$, $p=.283$), age ($\chi^2=.433$, $p=.510$), education ($\chi^2=.001$, $p=.981$), number of employees ($\chi^2=.178$,

p=.673), position ($\chi^2=.008$, p=.930), work experience ($\chi^2=2.301$, p=.129). Response bias was thus not a concern for this study. Table I documents the demographic information of these 430 respondents.

Table I Demographic information of survey respondents

Category	Item	Frequency	Percent
Gender	Male	213	49.53
	Female	217	50.47
Age	< 20	0	0
	20-30	287	66.74
	31-40	105	24.42
	41-50	30	6.98
	>50	8	1.86
Education	Secondary school or less	4	0.93
	Post-secondary study	41	9.53
	Bachelor level	228	53.02
	Master level or higher	157	36.51
Ownership nature	State Owned	241	56.05
	Privately Owned	110	25.58
	Joint Venture	35	8.14
	Foreign Owned	44	10.23
Organization size (# of employees)	< 100	115	26.74
	100-1000	116	26.98
	1001-2000	69	16.05
	> 2000	130	30.23
Current position	Junior	213	49.53
	Middle	165	38.37
	Senior	52	12.09
Overall work experience (number of years)	<5	224	52.09
	5-10	111	25.81
	11-20	64	14.88
	>20	31	7.21

In the survey questionnaire, we first defined Web 2.0 and listed the most popular Web 2.0 applications of virtual communities in China, such as Baidu Know, Baidu Document, Baidu Experience, Renren Network, Sina Microblog, Sina Blog. We indicated that the basic premise of Web 2.0 is that people are encouraged to participate in the shared creation of content, with knowledge seeking and contributing being major activities. Due to the ubiquitous Web 2.0 virtual communities, we indicated in the survey questionnaire that the respondent should respond according to the one Web 2.0 virtual community he/she uses most frequently. All data was collected in Chinese and translated into English for this paper.

Data analysis and results

Measurement model validation

Prior to data analysis, we first assessed measurement validity, including content validity, convergent validity and discriminant validity (Straub *et al.*, 2004). With regard to content validity, since all constructs and items are based on the previous literature, subject to minor improvements in wordings after the pilot survey, we thus believe each of them is accurately expressed and has a clear meaning. The whole measurement model consists of four constructs.

Table II shows the average variance extracted (AVE), composite reliability (CR) and Cronbach's Alpha of each construct. Convergent validity was assessed with Cronbach's Alpha and CR, and can be established with a score greater than 0.7. AVE can also help assess convergent validity and can be established with a score greater than 0.5 (Straub *et al.*, 2004). We can see that the smallest value of CR is 0.921, the smallest value of Cronbach's Alpha is 0.860, and the smallest value of AVE is 0.796, suggesting higher reliability and convergent validity of all the constructs.

Table II Overview of measurement model

Constructs	Items	AVE	CR	Cronbach's Alpha
Norm of reciprocity (NRECI)	2	0.877	0.935	0.860
Trust (TRU)	4	0.839	0.954	0.936
Web 2.0 usage for knowledge contributing (USAKC)	3	0.909	0.968	0.950
Web 2.0 usage for knowledge seeking (USAKS)	3	0.796	0.921	0.871

Table III shows loadings and cross loadings of factor analysis where all loadings (bold values) are much higher than cross loadings, suggesting sufficient discriminant validity and convergent validity for all constructs used in this study (Straub *et al.*, 2004).

Table III Loadings and cross loadings

Items	Component			
	1	2	3	4
USAKS1	.182	.005	.865	.242
USAKS2	.176	.123	.911	.185
USAKS3	.211	.382	.732	.089
USAKC1	.133	.912	.149	.109
USAKC2	.140	.952	.127	.044
USAKC3	.159	.927	.089	.003
TRU1	.837	.164	.189	.249
TRU2	.829	.116	.181	.321
TRU3	.896	.166	.146	.128
TRU4	.884	.127	.167	.170
NRECI1	.302	.018	.231	.863
NRECI2	.352	.121	.249	.813

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Common method bias

It was suggested that using single-source, self-reported data might have the potential for common method bias, while obtaining data from different sources can usefully help reduce common method variance (CMV). Harman's single-factor test has been arguably the most extensively applied approach for assessing CMV (Podsakoff *et al.*, 2003). The data in our study were collected from different sources, which is thus helpful for reducing CMV. Harman's single-factor test was performed with the complete data set by conducting a principal components analysis (PCA) in SPSS. The factor solution resulted in four factors with eigenvalues greater than 1.0, accounting for 86.155% of variance. At the same time, the first factor accounted for 27.982% of the variance, indicating that this factor does not account for the majority of the variance (Podsakoff *et al.*, 2003).

Furthermore, following the steps proposed by Zhou *et al.* (2007), we estimated three models: M1 was a method-only model in which all items were loaded on one factor; M2 was a trait-only model in which each item was loaded on its respective scale; M3 was a trait and method model in which a common factor linking to all the measurement items was added into M2. The results are indicated in Table IV. Since M2 is highly better than M1, while M3 is only slightly better than M2, which suggests that the trait rather than the common-method factor explains most of the variance. In this sense, common-method bias is not a major concern for the study.

Table IV Common method bias test

Fit indices	χ^2/df	GFI	AGFI	CFI	NFI	RMSEA
Recommended value	<3	>0.90	>0.80	>0.90	>0.90	<0.08
Actual value (Model 1)	2336.179/54=43.26	.548	.346	.496	.492	.314
Actual value (Model 2)	266.532/48=5.55	.903	.842	.952	.942	.103
Actual value (Model 3)	101.528/36=2.82	.961	.916	.986	.978	.065

Due to the validity of measurement model, it is thus appropriate to conduct further data analysis below. The score of the four constructs we examined in this study were each calculated based on their measurement models.

Comparing means

Web 2.0 virtual communities provide informal yet efficient platforms for knowledge sharing activity where employees can effectively exchange knowledge with outside people who share common interests, goals, needs or practices with them. For example, users of Baidu Know can ask any question which other users may be able to answer. According to the answers received, the user who asked a question can first compare all the answers according to his/her judgment and then flag the best answer. Baidu Know system records all these processes such that other users can easily search all the questions to locate the satisfactory answers.

This study explores the effect of individual differences, focusing on four aspects (constructs), namely: Web 2.0 usage for knowledge contributing (USAKC), Web 2.0 usage for knowledge seeking (USAKS), norm of reciprocity (NRECI), and trust (TRU). Accordingly, we use the statistical method of 'compare means', including independent samples t test for two groups of independent samples and one-way Analysis of Variance (ANOVA) for more than two groups of independent samples, so as to answer the first research question.

Table V shows the result of independent samples t test grouped by gender. The results suggest

that there are no significant differences except for Web 2.0 usage for knowledge contributing (USAKC). From Table V, it can be seen that the mean of USAKC for female employees is 3.026 while the mean for male employees is 3.700, suggesting that male employees are more likely to contribute their knowledge than female employees.

Table V Independent samples t test grouped by gender

Constructs	Gender	N	Mean	SD	t	Sig. (2-tailed)
NRECI	Male	213	5.129	1.309	-.465	.642
	Female	217	5.189	1.349		
TRU	Male	213	4.543	1.282	.681	.496
	Female	217	4.459	1.258		
USAKC	Male	213	3.700	1.692	4.311	.000***
	Female	217	3.026	1.546		
USAKS	Male	213	4.928	1.511	.786	.432
	Female	217	4.815	1.464		

*p<0.05; **p<0.01; ***p<0.001

Table VI shows the result of one-way ANOVA grouped by organization size. The results suggest that there are no significant differences except for Web 2.0 usage for knowledge contributing (USAKC). From Table VI, it can be seen that the mean for employees coming from organizations with number of employees between 100 and 1000 is 2.994, suggesting that this group of employees are less likely to contribute their knowledge.

Table VI One-way ANOVA grouped by organization size

Constructs	Number of employee	N	Mean	SD	F	Sig.	Multiple Comparisons
NRECI	< 100 (1)	115	5.257	1.215	.959	.412	
	100-1000 (2)	116	5.101	1.420			
	1001-2000 (3)	69	4.956	1.380			
	> 2000 (4)	130	5.234	1.310			
TRU	< 100 (1)	115	4.635	1.202	1.832	.141	
	100-1000 (2)	116	4.275	1.298			
	1001-2000 (3)	69	4.508	1.358			
	> 2000 (4)	130	4.580	1.240			
USAKC	< 100 (1)	115	3.359	1.513	3.064	.028*	2-4*
	100-1000 (2)	116	2.994	1.493			
	1001-2000 (3)	69	3.614	1.807			
	> 2000 (4)	130	3.551	1.777			
USAKS	< 100 (1)	115	4.790	1.399	1.586	.192	
	100-1000 (2)	116	4.700	1.551			
	1001-2000 (3)	69	4.879	1.471			
	> 2000 (4)	130	5.092	1.502			

*p<0.05; **p<0.01; ***p<0.001; Insignificant comparisons are omitted.

Table VII shows the result of one-way ANOVA grouped by position. The results suggest that there are no significant differences except for Web 2.0 usage for knowledge contributing (USAKC). From Table VII, it can be seen that the mean for employees with middle level position is 3.657, suggesting that this group of employees are more likely to contribute their knowledge.

Table VII One-way ANOVA grouped by current position

Constructs	Current position	N	Mean	SD	F	Sig.	Multiple Comparisons
NRECI	Junior (1)	213	5.057	1.293	1.547	.214	
	Middle (2)	165	5.223	1.361			
	Senior (3)	52	5.380	1.347			
TRU	Junior (1)	213	4.428	1.202	1.481	.229	
	Middle (2)	165	4.633	1.317			
	Senior (3)	52	4.379	1.366			
USAKC	Junior (1)	213	3.163	1.556	4.421	.013 *	1-2**
	Middle (2)	165	3.657	1.744			
	Senior (3)	52	3.224	1.634			
USAKS	Junior (1)	213	4.731	1.483	2.360	.096	
	Middle (2)	165	5.064	1.451			
	Senior (3)	52	4.836	1.575			

*p<0.05; **p<0.01; ***p<0.001; Insignificant comparisons are omitted

Table VIII shows the result of one-way ANOVA grouped by overall work experience. The results suggest that there are no significant differences except for trust. From Table VIII, it can be seen that the mean for employees with 5-10 years of work experience is 4.776, suggesting that this group of employees are most likely to trust other users, given the context of Web 2.0 virtual communities where users typically do not know one another or do not necessarily expect to meet face-to-face.

Table VIII One-way ANOVA grouped by overall work experience

Constructs	Overall work experience	N	Mean	SD	F	Sig.	Multiple Comparisons
NRECI	<5 (1)	224	5.089	1.266	1.669	.173	
	5-10 (2)	111	5.280	1.340			
	11-20 (3)	64	5.360	1.372			
	>20 (4)	31	4.825	1.572			
TRU	<5 (1)	224	4.426	1.241	2.881	.036 *	1-2*
	5-10 (2)	111	4.776	1.324			2-4*
	11-20 (3)	64	4.454	1.242			
	>20 (4)	31	4.145	1.208			
USAKC	<5 (1)	224	3.287	1.603	1.408	.240	
	5-10 (2)	111	3.613	1.706			
	11-20 (3)	64	3.140	1.713			
	>20 (4)	31	3.429	1.654			

USAKS	<5 (1)	224	4.837	1.491	1.905	.128
	5-10 (2)	111	4.895	1.497		
	11-20 (3)	64	5.171	1.443		
	>20 (4)	31	4.415	1.444		

*p<0.05; **p<0.01; ***p<0.001; Insignificant comparisons are omitted.

Furthermore, we conducted one-way ANOVA grouped by age, education and ownership nature, the results show no significant differences regarding the four constructs examined. We thus do not report the results for brevity.

Knowledge contributing and knowledge seeking represent two distinct types of behavior (He and Wei, 2009). In order to compare employees' knowledge seeking and knowledge contributing so as to answer the second research question, we use the statistical method of 'compare means', namely, the paired samples t test for dependent samples.

Table IX shows the result of paired samples t test between Web 2.0 usage for knowledge contributing (USAKC) and Web 2.0 usage for knowledge seeking (USAKS). From Table IX, it can be seen that the mean for USAKS is 4.871, while the mean for USAKC is 3.360, suggesting a strong and significant magnitude difference (1.511) between these two kinds of knowledge sharing behaviors.

Table IX Paired samples t test

	Constructs	Mean	N	SD	Paired Difference	t	Sig. (2-tailed)
Pair 1	USAKC	3.360	430	1.653	1.511	-17.361	.000***
	USAKS	4.871	430	1.487			

*p<0.05; **p<0.01; ***p<0.001

Correlation analysis

Users visit Web 2.0 virtual communities for the aim of inquiring and seeking knowledge from the outset (Li *et al.*, 2012) given certain reasons including institution-based trust, i.e., trust in the Internet and the virtual community (Chai and Kim, 2010). The basic premise of Web 2.0 is that people are encouraged to participate in the shared creation of content, with knowledge seeking and contributing being major activities. Consequently, trust among users can potentially develop through "repeated interactions with time" (Hsu *et al.*, 2007, p.157), and we suggest that knowledge seeking and knowledge contributing in Web 2.0 virtual communities reflect a kind of repeated interactions among users. Normally, users seek what other users contribute and contribute what other users seek. When users increase their usage of Web 2.0 virtual communities to repeatedly interact with each other over time by seeking and contributing knowledge, they are likely to gradually develop the 'strong ties' with other users (Kang *et al.*, 2011), thus facilitating the formation of trust among users (Suh and Shin, 2010).

We performed Pearson correlation analysis to explore the relationship between knowledge contributing, knowledge seeking, trust and norm of reciprocity so as to answer the third research question. The left section of Table X shows the mean and standard deviation (SD) of each construct. The right section shows the correlations between constructs.

Table X Descriptive statistics, correlations between constructs

	Mean	SD	N	NRECI	TRU	USAKC	USAKS
NRECI	5.159	1.328	430	1			
TRU	4.501	1.269	430	0.597***	1		
USAKC	3.360	1.653	430	0.203***	0.333***	1	
USAKS	4.871	1.487	430	0.504***	0.449***	0.342***	1

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (p is based on two-tailed t value)

From Table X, we can see that there are significant positive correlations between constructs. Specifically, the correlation between norm of reciprocity and trust is 0.597, the correlation between norm of reciprocity and knowledge contributing is 0.203, the correlation between norm of reciprocity and knowledge seeking is 0.504, the correlation between trust and knowledge contributing is 0.333, the correlation between trust and knowledge seeking is 0.449, and the correlation between knowledge contributing and knowledge seeking is 0.342.

Discussion and implications

With the development of Web 2.0 virtual communities, we see a useful platform for knowledge sharing. However, knowledge sharing in virtual communities still remains a big challenge due to the issues of knowledge quantity and knowledge quality. Informed by prior study, this study treated knowledge seeking and knowledge contributing separately, focusing on knowledge seeking and knowledge contributing in terms of actual behavior. To the best of our knowledge, no prior study has empirically examined knowledge seeking behavior and knowledge contributing behavior by employing paired samples t test to compare means between them or performing correlation analysis to explore the relationship between them. Furthermore, based on knowledge quantity and knowledge quality whose significance cannot be over-emphasized in virtual communities, this study explores employee perceptions of Web 2.0 virtual communities from the perspective of knowledge seeking, knowledge contributing, trust and reciprocity. We believe the findings of this study have important implications.

Regarding knowledge contributing which is critical for knowledge quantity in virtual communities, we found significant difference in terms of gender, organization size and position. It can be seen from Table V that female employees are less likely to contribute their knowledge. In this situation, female employees should be given more attention and much more encouraged to contribute their knowledge. From Table VI, it can be seen that employees from the medium organizations (the number of employee is between 100 and 1000) are less likely to contribute their knowledge. This suggests knowledge contributing seems to be inhibited in medium organizations. But the reason for this needs further investigation. From Table VII, it can be seen that employees with middle level position are more likely to contribute their knowledge than junior employees. We suggest the reason for this might be that, the employees with middle level position tend to have more confidence in knowledge contributing compared with junior employees.

As for ownership nature, this study examines four natures, viz.: state owned, privately owned,

joint venture, foreign owned. It is reasonable to suggest that different ownership nature represents different organizational culture to some extent. Meanwhile, culture can reflect the core value of an organization, thus shaping the cognitive processes of its members and determining their beliefs and behaviors such as knowledge contributing (Thatcher et al., 2003). However, this study didn't find any significant difference in terms of ownership nature. To the best of our knowledge, prior study has never investigated the effect of ownership nature on employee knowledge sharing in Web 2.0 virtual communities, thus inviting further research. As for education, this study examines four levels, viz.: secondary school or less, post-secondary study, bachelor level, master level or higher. This study didn't find any significant difference among employees with different levels of education in terms of their perceptions of knowledge sharing in Web 2.0 virtual communities. Even though employees who received higher levels of education seem to probably own more knowledge, it is reasonable to believe that much knowledge especially tacit knowledge such as experiences, techniques, insights are often acquired and accumulated through work practice. As for age, this study examines four groups, viz.: 20-30, 31-40, 41-50, >50. This study didn't find any significant difference among various age groups of employees in terms of their perceptions of knowledge sharing in Web 2.0 virtual communities. It is reasonable to suggest that older employees who own rich knowledge and experience would less likely to seek knowledge but more likely to contribute knowledge; younger employees who lack work experience would more likely to seek knowledge but less likely to contribute knowledge. We suggest this might suit face-to-face context. However, our study targeted the context of Web 2.0 virtual communities which seem to attract more young employees. We thus suggest the insignificant difference in terms of age is acceptable.

Knowledge sharing is of strategic importance (Wang and Wei, 2011). From Table IX, it can be seen that the mean for knowledge seeking is significant larger than that of knowledge contributing. This finding is consistent with prior research in the specific context of open source software, such as the research by Kuk (2006) who examined the impact of strategic interaction including participation inequality, conversational interactivity, and cross-thread connectivity on knowledge sharing, and the research by Toral *et al.* (2009) who provides insights into the importance of an involved core of individuals inside the community. This finding is also consistent with the 1% rule in Internet culture which suggests that only 1% of the users of a website actively create and contribute new content, while the other 99% of the participants only seek and lurk (Wikipedia, 2013). It is reasonable to believe that users of a Web 2.0 virtual community are most likely to use it initially in order to seek knowledge from rather than contribute knowledge to the community, which may partially explain this finding.

Knowledge contributing has long been recognized as a bottleneck in knowledge sharing activity since contributors tend to expect to receive some value in return (Yan and Davison, 2013). There is evidence to show that popular Chinese Web 2.0 virtual communities have invited experts to play the role of contributors at the early stage of development. During our observations of some popular Chinese Web 2.0 virtual communities, we found some users often contributed more than 100 times a day, essentially functioning as experts. However, it is least likely to be an ideal way to heavily depend on experts given the long term strategic development of virtual communities. In the long run, virtual communities need voluntary contributors so as to highlight the real meaning of knowledge sharing initiative, which implies that "the significance of member-generated content (knowledge) cannot be over-emphasized" (Chiu *et al.*, 2006, p. 1873). Web 2.0 virtual

communities encourage people who have common interests, practices or goals to participate in the shared generation of content in the hopes that users' collaborative work can be accumulated to become the assets of the communities (Chiu *et al.*, 2006; Liao and Chou, 2012). Compared with experts, crowd wisdom has been increasingly acknowledged and appreciated. It is suggested that the online collective wisdom is usually correct even though critics tend to point out tremendous errors and total distortions on the Web (Ross and Sennyey, 2008). The knowledge value and reliability of user generated Wikipedia compares favorably to that of traditional encyclopedias produced by experts (Fallis, 2008). From Table X, it can be seen that knowledge seeking is positively related with knowledge contributing with the magnitude being 0.342. So, if users frequently seek knowledge in Web 2.0 virtual communities, they tend to frequently contribute knowledge. This finding presents an encouraging prospect and we believe the participation inequality in Web 2.0 virtual communities would be gradually reduced. Consequently, the ideal stage of Web 2.0 virtual communities can be achieved with knowledge sharing activity dynamically and continually maintained by the normal users themselves.

Regarding knowledge quality in virtual communities, relationship-based trust is critical since it has significant and positive effect on knowledge quality (Chiu *et al.*, 2006). In other words, it makes reliance on relationship-based trust essential to guarantee the quality of knowledge rather than reliance on the traditional gate-keeping on the knowledge production side. On the Internet, a virtual community with a website represents an institution to some extent (Zha *et al.*, 2013). For example, users who initially visit Baidu Know which is the biggest Chinese ask-answering platform are likely to be enabled by trust in Baidu which is a famous listed Internet company in China. In this sense, trust in Baidu Know is kind of institution-based trust. In the context of virtual communities, trust in a website (an institution) is suggested to be an initial condition for users to participate in knowledge sharing activities (Chai and Kim, 2010; Zha *et al.*, 2013). In this study, we focus on relationship-based trust which "emerges on the basis of recurring social interactions between trustor and trustee, and takes root when actors get to know one another and are able to predict what to expect and how the other party will behave in a certain situation" (Ardichvili 2008, p. 547). This kind of relationship-based trust among individuals is difficult to develop (Ridings *et al.*, 2002) in virtual communities given virtual communities sharply contrasts with traditional communities where people typically know one another (Wasko and Faraj, 2005).

This study examines trust in the context of knowledge sharing. From Table X, we can see that norm of reciprocity has a strong correlation with trust with the magnitude being 0.597, concordant with the finding by Suh and Shin (2010). Meanwhile, we can see that both knowledge contributing and knowledge seeking have correlations with trust. Specifically, the correlation between knowledge seeking and trust is relatively larger than the correlation between knowledge contributing and trust. Now matter whether it is knowledge seeking or knowledge contributing, it is reasonable to suggest that knowledge sharing and trust can inform each other. Indeed, trust is related to the desire to give information and get information in virtual communities (Ridings *et al.*, 2002). Given the positive correlations between trust, norm of reciprocity, knowledge contributing and knowledge seeking, we suggest knowledge quality and knowledge quantity in virtual communities can be achieved in the long run, with the results that organizational members benefit from knowledge sharing through external network connections.

We suggest the findings of this study in the context of Web 2.0 virtual communities also have practical implications for knowledge sharing practices in organizational contexts. We recommend

that organizations should adjust their knowledge management strategy, namely, not necessarily searching for the development of formal KMS inside the boundary of the organization. Rather, they can seize the opportunity to encourage informal knowledge sharing activity in Web 2.0 virtual communities beyond the organizational boundary. This is critical given knowledge management initiatives in practice are relatively fewer in China than in Western countries even though Chinese government policy strongly encourages knowledge sharing and knowledge creation across contemporary organizations of all industries and fields (Yan and Davison, 2013).

In the context of Web 2.0 virtual communities, knowledge exchange and sharing that cross organizational boundaries can be informal and free from the constraints of local hierarchy (Wasko and Faraj, 2005). In this situation, employees are likely to feel free from the shadow of fearing the loss of knowledge power which unfortunately is a strong belief held by many Chinese employees (Martinsons and Westwood, 1997; Huang *et al.*, 2011). Knowledge sharing in virtual communities can thus hopefully facilitate knowledge especially tacit knowledge such as experiences, techniques, insights to be shared freely and unconsciously among users. Furthermore, knowledge sharing in virtual communities should be much encouraged given “most organizations do not possess all required knowledge within their formal boundaries and must rely on linkages to outside organizations and individuals to acquire knowledge” (Wasko and Faraj, 2005, p. 36). Consequently, according to the findings of this study, when users seek and contribute knowledge more frequently in virtual communities, trust is more likely to reach a higher level, which further leads to knowledge quality (Chiu *et al.*, 2006). Only in this way, can organizations especially the small and medium ones in China have the opportunity to initiate knowledge management practice, thus facilitating knowledge sharing to potentially result in new values for the organization.

Conclusion

Knowledge management initiatives in Chinese organizations are encountered relatively less frequently, compared with Western countries. One reason might be that most Chinese employees hold a strong belief that knowledge contributing means losing knowledge power (Martinsons and Westwood, 1997; Huang *et al.*, 2008). However, with the development of Web 2.0 applications, we see a useful platform for knowledge sharing. In Web 2.0 virtual communities, a user is not only a consumer but also a creator of information and knowledge. Consequently, the significance of knowledge quantity and knowledge quality cannot be over-emphasized (Chiu *et al.*, 2006). This study explores the effect of individual differences on knowledge contributing, knowledge seeking, trust and reciprocity and employs paired samples t test to compare means between knowledge seeking and knowledge contributing. Meanwhile, this study explores correlations between knowledge contributing, knowledge seeking, trust and reciprocity. We suggest the findings of this study provide useful insights into the informal knowledge sharing in Web 2.0 virtual communities, which is helpful for guiding knowledge management practice in China. Given this study targeted Chinese context, generalizing the results to other settings needs further investigation.

Tremendous amounts of energy and investment have been ploughed into the development of KMS in organizations. However, lots of money is lost per year due to the failure of knowledge sharing (Wang and Noe, 2010). Compared with the formal (and expensive) KMS used or expected to be used inside organizations, Web 2.0 virtual communities provide informal yet efficient platforms for knowledge sharing activity where employees can exchange knowledge with outside

people who share common interests, goals, needs or practices with them. We thus suggest that further study is needed to examine knowledge quantity and quality issues in the context of formal KMS and make a comparison between these two contexts. We believe this further study would lead to more interesting findings which would usefully complement the study presented here.

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Appendix Constructs and items

Constructs	Items
Norm of reciprocity (adapted from Chiu <i>et al.</i> , 2006)	<ol style="list-style-type: none">1. I know that other members on the Web 2.0 application will help me, so it is only fair to help other members.2. I believe that members on the Web 2.0 application would help me if I need it.
Trust (adapted from He and Wei, 2009)	<ol style="list-style-type: none">1. I have faith in other users of the Web 2.0 application and trust them.2. I believe in the good intent and concern of other users of the Web 2.0 application.3. I believe in the reliability of other users of the Web 2.0 application.4. I am confident in the integrity of other users of the Web 2.0 application.

Web 2.0 usage for
knowledge contributing
(adapted from
Kankanhalli *et al.*, 2005;
Venkatesh *et al.*, 2003)

1. I often use the Web 2.0 application to contribute my knowledge.
2. I frequently use the Web 2.0 to contribute my knowledge.
3. I spend a lot of time using the Web 2.0 application to contribute my knowledge.

Web 2.0 usage for
knowledge seeking
(adapted from
Kankanhalli *et al.*, 2005;
Venkatesh *et al.*, 2003)

1. I often use the Web 2.0 application to seek knowledge.
 2. I frequently use the Web 2.0 application to seek knowledge.
 3. I spend a lot of time using the Web 2.0 application to seek knowledge.
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