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DRIVERS OF KNOWLEDGE CONTRIBUTION QUALITY AND QUANTITY IN ONLINE QUESTION AND ANSWERING COMMUNITIES

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Abstract

A large portion of previous research on knowledge sharing in virtual community focuses on organization-sponsored professional virtual communities (PVC) while nowadays numerous non-work-related virtual communities are gaining popularity. This study investigates the phenomenon of knowledge sharing in one popular type of non-work-related virtual community, online question and answering community. Anchoring on the self-determination theory, this study identifies three types of motivations to share knowledge in the community. Particularly, rewards in reputation system, which we further divide into rewards for quantity and for quality, are classified as extrinsic motivation; learning is classified as internalized extrinsic motivation and enjoy helping is classified as intrinsic motivation. Moreover, while previous studies tend to hold a monolithic view of knowledge contribution, this study regards quantity and quality as two important parts of knowledge contribution and argues there are different underlying mechanisms leading to them. Therefore we investigate the effects of the three motivations on quantity and quality separately. An online survey with 367 participants was conducted in a leading Chinese online question and answering community to test the research model. Results show that the motivational factors do have different effects on quality and quantity of knowledge contribution. While rewards in reputation systems for quantity can effectively enhance knowledge contribution quantity, rewards for quality do not lead to high quality knowledge contribution. Learning is revealed as a crucial motivational factor in this context as it is positively related with both aspects of knowledge contribution. Finally, enjoy helping is weakly related with knowledge contribution quality and strongly associated with knowledge contribution quantity. Both theoretical and practical implications are discussed.

Keywords: online question and answering community, motivation, knowledge contribution quantity, quality

1   INTRODUCTION

Almost one decade after the introduction of the term "Web 2.0", the outlook of how online users generate, share and disseminate knowledge has been utterly changed by the introduction of various virtual communities (VCs) that allow user-generated content (UGC). The proliferation of VCs attracts great interest from researchers with a majority of them focusing on organization-sponsored professional virtual communities (PVCs) that are closely related with work and organizations' business objectives (Bock et al. 2005; Chiu et al. 2006; Zhang et al. 2010). However, nowadays numerous non-work-related VCs are flourishing and call for more research (Ren et al. 2007).

Online question and answering (Q&A) communities, which leverage community wisdom and organize knowledge exchange in the form of asking and answering questions (Jin 2009), with contents covering various aspects of daily life, represents one popular type of non-work related VC. Boasting high level information relevance, since knowledge seekers can get straightforward answer from community users (Xu & Chen 2006), online Q&A communities attract an increasing number of visitors and bring about enormous commercial success. There are a large number of online Q&A communities in all kinds of languages, among which the Korean Naver Knowledge-iN, English Yahoo! Answers, and Chinese Baidu Knows represent the most successful ones.

Just like any virtual community, the sustainability of online Q&A communities depends on users' knowledge contribution. Given the fact that there is no financial incentive or formal employment contract in those communities (Ren et al. 2007), not to mention the wide availability of alternatives, understanding the reasons behind users' knowledge contribution is especially important. Therefore, the first research question of this study is to identify the key factors that drive voluntary knowledge contribution in the context of online Q&A communities. To this end, we anchor on the prominent motivation theory, self-determination theory (Deci & Ryan 1985; Ryan & Deci 2002) to identify a comprehensive set of motivations in the context of online Q&A communities as the key drivers of knowledge sharing.

The self-determination theory has been widely applied in a variety of disciplines including IS with demonstrated validity (e.g. Baard et al. 2004; Lakhani & Wolf 2005). The theory contains that human motivation broadly comes from three sources: external regulation, mainly referring to reward contingencies; internalized extrinsic motivation, meaning internalized values that originally come from external source, and intrinsic motivation, denoting the inherent satisfaction of the behaviour per se. In the context of online Q&A communities, rewards in reputation system are designed to replace financial incentive and function as external regulation. Learning represents the most relevant internalized value since users can exercise existing knowledge and explore unknown things by contributing knowledge in the community. Consistent with previous research, enjoy helping is framed as the intrinsic motivation.

Meanwhile, a large number of knowledge sharing studies tend to hold a monolithic view of the knowledge contribution. Particularly, they look at users' intention or behaviour of knowledge contribution in using certain knowledge management system, with major focus on usage frequency or contribution quantity (e.g. Kankanhalli et al. 2005; Ma & Agarwal 2007). However, quantity alone is not enough for a community to survive, especially for online Q&A communities where knowledge seekers come for answers valuable to them, as compared with some other virtual communities such as chatting room where participants mainly seek joy and leisure. Therefore, we follow Wasko and Faraj (2005) and Chiu et al.(2006)'s studies and argue that quality and quantity constitutes two essential parts of knowledge contribution and should be treated separately. Since there are relatively few studies adopting this approach, we currently have limited understanding about whether quality and quantity have different determinants and, if so, what would be the underlying influencing mechanisms. To bridge this gap, the second research question of this study is to investigate whether the three motivations we identify have different underlying mechanism in influencing knowledge sharing quality and quantity, and we also aim to find out whether the differences in underlying mechanisms can lead to different effect of those drivers on the two aspects of knowledge sharing.

An online survey with 367 participants was conducted in a leading Chinese online Q&A community to test the research model. Results show that driven by different underlying influencing mechanisms, motivations do have different effects on quality and quantity. While rewards in reputation systems for quantity can effectively enhance knowledge contribution quantity, rewards for quality do not lead to high quality knowledge contribution. Learning is revealed as a crucial motivational factor in this context as it is positively related with both aspects of knowledge contribution. Finally, enjoy helping is weakly related with knowledge contribution quality and strongly associated with knowledge contribution quantity.

This paper makes several important contributions. First, it differentiates online Q&A community, a type of non-work-related virtual communities, from well-studied professional virtual communities, thereby extending our understanding of knowledge contribution determinants in the new context. Particularly, in differentiating online Q&A communities from other virtual communities, we reveal the importance of rewards in reputation system and learning motive in this context. Second, it proves that the monolithic view of knowledge contribution is not accurate; quality and quantity as two crucial parts of knowledge contribution have different underlying mechanisms leading to them. There are significant practical implications as well. For example, online Q&A community developers should spend more effort in developing more attractive rewards targeting knowledge contribution quantity to ensure the sustainability of the community.

The rest of the paper is organized as follows: in theoretical background, we start with comparing online Q&A communities with other virtual communities and based on the comparison, we propose the three major motivational factors in this context. Next, we propose the research model and hypotheses. This is followed by a detailed description of methodology and data analysis. Theoretical and practical implications are discussed.

2 THEORETICAL BACKGROUND

2.1 Online Q&A community

Online Q&A community, which is also known as community-based Q&A, is a relatively new form of online knowledge sharing community. It emerges from traditional online question answering (Q&A) services which generally rely on information extraction from knowledge base (e.g. Wikipedia) or webpages (e.g. MIT START) or hired experts (Google answer, but it is shut down now) for answers. Online Q&A communities allow users to ask all kinds of questions in natural language for free (Kim et al. 2007) and leverages the time and effort of community users for answers (Harper et al. 2008). They organize knowledge exchange in the form of asking and answering questions (Jin 2009) therefore allow knowledge seekers to get straightforward answers (Xu & Chen 2006). Compared with other kinds of virtual communities, especially those well-studied organization-sponsored professional virtual communities (PVCs), online Q&A communities distinguish themselves in following ways.

First, online Q&A communities drastically differ from PVCs in that there is no organizational reward acting as incentive for knowledge contribution. Previous literature shows that organizations tend to provide various rewards such as bonus, job security to act as positive reinforcement of knowledge contribution (Ba et al. 2001). Empirical evidence also proved the effectiveness of such rewards (Kankanhalli et al. 2005; Roberts et al. 2006). Besides, some expert Q&A services like Google answer also pay their experts for knowledge contribution. However, the operation of online Q&A community is built on free knowledge exchange. The shortage of those tangible rewards calls on community designers to develop other alternatives to function as incentive mechanism. Driven by this reason, rewards in reputation system are leveraged to function as the major incentive.

Second, the size of online Q&A communities is generally much larger than many PVCs which usually involve employees of one or several companies. This can be accounted for by the wide range of topics covered in online Q&A communities, which attracts huge number of users from distinct background. Under such circumstances, it is very difficult for them to know each other, making knowledge sharing drivers such as reciprocity, which is proved very important in previous literature (Bock et al. 2005;

Wasko & Faraj 2005) quite irrelevant, since they have no idea who they are helping and have no expectation of getting reciprocated (Lakhani & Hippel 2003).

Third, compared with many other non-work-related virtual communities which are mainly for relaxation and fun, online Q&A communities boast a focus on providing valid answer. Unlike some virtual communities such as online chatting room and BBS (Bulletin Board System) in which participants can engage in many activities such as expressing emotions, describing the daily life, the knowledge exchange process in online Q&A communities is strictly limited to question asking and answering, making the platform an ideal place for focused information search. Moreover, answers for each question will be evaluated in terms of quality. To be more specific, for each question, one best answer will be selected, either by the knowledge seeker or community voting on the basis of content value, cognitive value, socio-emotional value, etc. (Kim et al. 2007).

2.2 Motivations to share knowledge in online Q&A communities

We anchor on the self-determination theory (Deci & Ryan 1985; Ryan & Deci 2002), a major motivation theory in social psychology to identify three types of motivation as drivers of knowledge contribution in the context of online Q&A communities. According to the self-determination theory, motivations are first broadly divided into intrinsic and extrinsic motivation. Intrinsic motivation derives from the inherent satisfaction of the behaviour per se, rather than from reward contingencies or reinforcements that are separable from the activity; having fun or enjoying oneself when taking part in an activity is at the core of intrinsic motivation (Deci & Ryan 1985; Ryan & Deci 2000). In contrast, extrinsic motivation focuses on contingent outcomes that are separable from the action (Ryan & Deci 2002). It can be further divided into external regulation and extrinsic motivation by internalization, or "internalized extrinsic motivation" (Roberts et al. 2006). External regulation is totally imposed by external force, referring to being motivated to obtain rewards or avoid punishment. It is the central concern of operant conditioning theory (Skinner 1953). Internalized extrinsic motivation lies between external regulation and intrinsic motivation and it refers to values such as respect, learning, self-esteem, etc., that comes from external influence at the beginning and later become one's own through the process of internalization (Ryan & Deci 2002).

External regulation in previous studies usually includes organizational reward. In the context of online Q&A communities, it is replaced by "reward in reputation system", an IT artefact that community designers develop to function as the major incentive mechanism. Reputation system has been widely discussed in previous research as a technical mechanism to reduce risk therefore generating trust (Jøsang et al. 2007; Pavlou & Gefen 2004; Resnick et al. 2000). But in this context, reputation system not only serves the traditional rule, but also constitutes an important incentive mechanism, which we call "rewards in reputation system", by providing various rewards in recognition of users' knowledge contribution. They have been extensively implemented in online Q&A communities where the provision of traditional rewards such as money and job promotion is impossible. The basic idea of rewards in reputation system is just the same as traditional rewards: if a user contributes knowledge, certain scores shown in various presentation formats in the reputation system will be raised. Despite the large variety of presentation formats, rewards in reputation system can be classified into two categories, one targeting at quantity and the other aiming at quality. While the former one rewards users' input of any information, no matter useful or not, the latter one acknowledges valid knowledge input, especially those that are chosen as the best answer either by knowledge seeker or community voting.

Based on the self-determination theory, internalized extrinsic motivation lies between external regulation and intrinsic motivation, and learning is one important type of it. In this context, we define it as the belief that contributing knowledge can benefit self-learning by exercising existing knowledge or exploring unknown things. Online Q&A communities position themselves as an ideal place for focused information search and contributed knowledge will be evaluated for best answer selection, therefore participants are implicitly required to input relevant information. In this process, participants can effectively practice their existing expertise and explore unknown things (Daugherty et al. 2005; Yu et al. forthcoming). Therefore, learning constitutes a major internalized extrinsic motivation in online Q&A communities.

Consistent with self-determination theory and previous knowledge sharing studies, enjoy helping is framed as the intrinsic motivation, and is defined as the perception of pleasure gained from helping fellow users by contributing knowledge to the online Q&A community (Wasko & Faraj 2000; Wasko & Faraj 2005). It comes from participants' intrinsic enjoyment when contributing knowledge and has nothing to do with reward contingencies or other people's values.

3   HYPOTHESES DEVELOPMENT

Based on the self-determination theory and the three types of motivations (rewards in reputation system, learning and enjoy helping), the research model (Figure 1) is proposed.
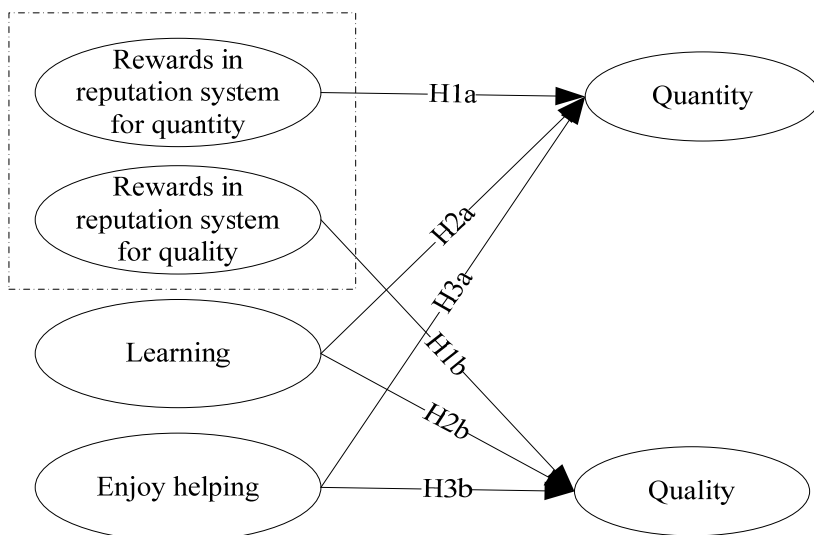

Figure 1. Research model

3.1   External regulation

Due to the free nature of online Q&A communities, rewards in reputation system act as the sole external regulation. Its working mechanism is similar with traditional rewards, i.e. when a user contributes knowledge he/she can get some rewards. Such rewards, although non-monetary, will be shown in various presentation formats in each user's profile in the reputation system provided by online Q&A communities. For example, Baidu Knows provides up to ten presentation formats like achieved level, accumulated points, best answer rate to showcase users' achievements. With these rewards, participant's performance ranking in the community can be raised; some communities allow users to convert these virtual rewards into actual gifts and some allows user to exchange access to their for fee service with these rewards. Therefore, reputation system moves beyond the traditional role of risk reducer and starts to act as an important positive reinforcer that encourages knowledge exchange.

The two types of rewards in reputation system (one for quantity, the other for quality) has different target. The rewards for quantity acknowledge users' knowledge contribution behaviour, regardless of quality. As a result, they become track records of users' activeness and worm-heartedness. Online Q&A communities rely on such rewards as structural assurance (Pavlou 2002) to distinguish active users from non-active ones. Motived to establish and maintain an image as active users who frequently help others, users are likely to contribute more knowledge. Previous research has shown that by showing online users how much others have contributed can motivate them to contribute more due to the social comparison process (Harper et al. 2007).

Rewards in reputation system for quality are recognition of users' valuable knowledge contribution. It is a positive feedback to users' knowledge and expertise. Studies in psychology show that positive feedback of individuals' competence can lead to higher performance (Ryan et al. 1983). To conclude,

rewards in reputation system can motivate community users to contribute high quality knowledge. Therefore, we propose that:

H1a: rewards in reputation system for quantity are positively associated with participants' knowledge contribution quantity.

H1b: rewards in reputation system for quality are positively associated with participants' knowledge contribution quality.

3.2 Internalized extrinsic motivation

Learning is a kind of internalized extrinsic motivation since it does not stem from the internal enjoyment of the activity per se, but is a social value that is internalized by knowledge contributors. During the process of contributing knowledge, users can practice existing expertise and explore unknown things (Daugherty et al. 2005; Yu et al. forthcoming). This motivation is especially relevant in this context due to the community norm that limits knowledge exchange to topic-relevant question answering without the interruption of casual chatting.

The learning motive can lead community participants to contribute more knowledge. When contributing knowledge, participants can learn from explaining their idea to others (Boud et al. 2001). Meanwhile, answering others' questions involves certain level of information processing (Yu et al. 2007), since it requires contributors to search their knowledge pool or other sources to give a solution. This process benefits individuals in practicing and consolidating their knowledge and critical thinking. Being aware of these facts, users will be motivated to engage in knowledge sharing frequently to harvest the benefits to a greater extent.

The learning motive can also lead community participants to contribute high quality knowledge. The desire of learning can bring about curiosity (Berlyne 1978), so when encountering unknown or unsure questions, participants do not easily give up, instead they search for more relevant information to try to answer the question. Similar finding can be found in marketing research, which shows that when consumers' curiosity towards a brand is aroused, they will be evoked to search for further brand-related information (Smith & Swinyard 1988). Searching for relevant information can lead to better quality of knowledge contribution. Therefore, we propose that:

H2a: learning motive is positively associated with participants' knowledge contribution quantity.

H2b: learning motive is positively associated with participants' knowledge contribution quality.

3.3 Intrinsic motivation

Enjoy helping as the intrinsic motivation represents individual's energy when pursuing a goal or doing an activity because of its innate interest (Deci & Ryan 1985). Its importance for knowledge contribution has been well established in previous research (Kankanhalli et al. 2005; Wasko & Faraj 2005; Yu et al. forthcoming).

According to self-determination theory, people with stronger intrinsic motivation tend to perform better in terms of quality compared with those with low intrinsic motivation (Deci & Ryan 1985), since they are willing to put in more cognitive effort, which leads contributors to search for more relevant information. Similarly, Smith and Kollock (1999) found that knowledge contributors with higher intrinsic motivation provide more useful advices and Wasko and Faraj (2005) proved this empirically.

Intrinsic motivation drives knowledge contribution quantity has been well-established in previous studies (Kankanhalli et al. 2005; Wasko & Faraj 2005; Yu et al. forthcoming). Since participants can feel personal enjoyment in answering questions, as well as in helping others in need (Wasko & Faraj 2000), they are willing to do it every now and then to feel such kind of joy. Therefore, we propose that:

H3a: enjoy helping is positively associated with participants' knowledge contribution quantity.

H3b: enjoy helping is positively associated with participants' knowledge contribution quality.

3.4   Control variable

To test the effects of the above-mentioned motivations on the quantity and quality of knowledge contribution, we control for another significant factor that may influence the dependent variables, knowledge self-efficacy. It refers to a user's confidence in his/her ability to provide knowledge that is valuable to other users. It is well documented in the literature that individuals with higher confidence in their ability give more helpful advice (Constant et al. 1996). Meanwhile, higher self-efficacy also encourages individuals to contribute more (Wasko & Faraj 2000).

4   METHODOLOGY

4.1   Data collection

A leading Chinese online Q&A community, Baidu Knows, was chosen as the research site of this study as it is a typical example. It was launched in June 21, 2005 by the biggest Chinese search engine Baidu and later became one of the most successful online Q&A communities in China. Like other online Q&A communities, askers can type in their questions in natural language to look for a direct answer. If there's none, the asker can post the question, waiting other users to answer. After the question is posted, any interested community users can respond by posting their answers. Within certain time, a best answer will be chosen among all the answers to one question, either by the asker or community voting. Rewards in reputation system are used as the major incentive by the website. As a manifestation of the importance of the rewards in reputation system, the system will automatically generate a profile for each user showing his/her accumulated rewards in the website. As is mentioned in 2.2, there are broadly two types of rewards, one for quantity and the other for quality. The former one acknowledges knowledge contribution regardless of quality and is demonstrated in such form as "experience points", "level", etc. The latter one rewards participants' valid knowledge input and is commonly shown by users' best answer rate, i.e. the percentage of best answer in the total number of answers posted by a user. Each user's profile can be accessed by clicking the username; a mini-profile showing a user's level and best answer rate is placed on the right side of username which appears whenever a user answers question.

Users of Baidu Knows are invited by the instant messenger provided by the community to participate in the online survey. We finally received 371 responses among which 4 were deleted as they came from the same IP address and same username. As we designed the online questionnaire in a way that required users to complete all the questions before they can submit, there is no missing value in all the responses, resulting in a final sample of 367 valid responses. Among the respondents, 65% are male, 93% are below the age of 35 and 63% have college degree.

4.2   Instruments

The majority of measurement items are adopted from previous studies to ensure validity and reliability (see Appendix A). Some adjustments are made for some items to better suit the context of online Q&A communities. The measurements are all assessed using seven-point Likert scale ranging from 1=strongly disagree to 7=strongly agree. The four items for the construct enjoy helping, are adapted from Kankanhalli, et al. (2005). The four items for knowledge contribution quantity are adapted from Ma & Agarwal (2007) and Yu, et al. (forthcoming). The seven items or knowledge contribution quality come from Chiu, et al. (2006)'s study with an additional item about contributors' overall assessment of their own knowledge contribution quality.

Since there is no existing measurement for rewards in reputation system for quantity/quality, we develop the measurement by replacing various organization rewards in Kankanhalli, et al. (2005)'s measurement for the construct "organizational reward" with some common reward presentation formats we observe in online Q&A communities. For example, for the measurement of "rewards in reputation system for quantity", we substitute organizational rewards with "experience points", "level"

and "virtual wealth", which are commonly adopted by online Q&A communities as rewards for the quantity of knowledge contribution. Similarly, for the measurement of "rewards in reputation systems for quality", we substitute organizational reward with "best answer rate", the most popular reward for knowledge contribution quality in these communities. Meanwhile, as there is no systematic measurement for the construct learning, we adopt the measurement items from several resources (Clary et al. 1998; Nam et al. 2009; Yu et al. 2007). The two items for the control variable, knowledge self-efficacy, is also adapted from Kankanhalli, et al. (2005)'s study.

5 DATA ANALYSIS

Structural equation modelling (SEM), a powerful second-generation statistical technique to test the relationships between the observed variables and latent variables and among latent variables, is used to test the research model. SmartPLS 2.0 is used as the analysing technique. We follow Anderson and Gerbing (1988)'s two-step approach in examining the measurement model and structural model.

5.1 Measurement model

Reliability, meaning the consistency of measurement, is examined by composite reliability. As shown in Table 1, the values of composite reliability for each construct all well exceed 0.7 cut-off (Fornell & Larcker 1981), confirming the internal consistency of indicators. To test convergent validity, average variance extracted (AVE) was assessed. As we can see in Table 1, all AVE values are above the threshold 0.5 (Chin 1998). In sum, construct reliability and convergent validity are ensured. Table 1 also assessed discriminant validity. It was done by comparing construct correlations and the square root of AVEs (Fornell & Larcker 1981). As we can see in Table 1, the square root of AVE (diagonal elements) for each construct is larger than its correlation with other constructs (off-diagonal elements). Thus, the discriminant validity of measurement items is also established.

Moreover, confirmatory factor analysis (CFA) was also conducted to confirm the discriminant validity and convergent validity. CFA shows that all item loadings for each construct are above 0.7, well exceeding the acceptable value 0.5 (Hair et al. 1998), confirming the convergent validity. Moreover, the loadings of each item on their respective constructs are much higher than others, further demonstrating discriminant validity. In summary, the instruments of the survey prove satisfactory reliability and validity.

Construct	Composite reliability	AVE	Construct						
			RS for quantity	RS for quality	Learning	Enjoy	Self-efficacy	Quantity	Quality
RS for quantity	0.91	0.77	**0.88**						
RS for quality	1.00	1.00	0.58	**1.00**					
Learning	0.92	0.69	-0.01	0.13	**0.83**				
Enjoy	0.92	0.73	0.08	0.19	0.64	**0.85**			
Self-efficacy	0.93	0.86	0.11	0.17	0.51	0.54	**0.93**		
Quantity	0.94	0.79	0.16	0.17	0.54	0.61	0.58	**0.89**	
Quality	0.93	0.66	0.10	0.11	0.48	0.49	0.64	0.62	**0.81**

Note: **RS for quantity**-Reward in reputation systems for quantity;

    RS for quality-Reward in reputation systems for quality;

    Enjoy-Enjoy helping; **Self-efficacy**-Knowledge self-efficacy.

    The numbers in bold in the diagonal row are square roots of AVE.

Table 1. Reliability and validity

Since all the data are self-reported using survey methodology, common method bias is a potential threat to internal validity. To address this threat, we conducted an exploratory factor analysis following Harman's one-factor test (Podsakoff & Organ 1986). Results did not show a single factor accounting for the majority of variances in all items. Therefore we conclude common method bias does not pose serious threat to the study.

5.2   Structural model

The overall results of structural model are summarized in Table 2. Rewards in reputation system for quantity has significant positive effect on quantity of knowledge contribution ($\beta=0.13$, $t=2.72$), supporting H1a. Meanwhile, rewards in reputation system for quality has no significant effect on knowledge contribution quality ($\beta=-0.06$, $t=1.23$), rejecting H1b. Learning has significant positive effect on both quantity and quality of knowledge contribution, supporting H2a ($\beta=0.18$, $t=3.26$) and H2b ($\beta=0.15$, $t=2.15$). Enjoy helping has significant positive effect on knowledge contribution quantity, supporting H3a ($\beta=0.33$, $t=6.34$), and it also has marginal effect on quality of knowledge contribution, partially supporting H3b ($\beta=0.14$, $t=1.83$). All the independent variables and the control variable together explain 49.5% variance of knowledge contribution quantity and 45.2% for quality of knowledge contribution.

In addition to the hypotheses, we also tested the links of rewards in reputation system for *quantity*-knowledge contribution *quality* and rewards in reputation system for *quality*-knowledge contribution *quantity* to see whether the two types of rewards in reputation system have unintended effects. The insignificant effect of rewards for quantity on knowledge contribution quality ($\beta=0.07$, $t=1.47$) rules out its unintended effect. And the unintended effect of reward in reputation system for quality on quantity also does not exist ($\beta=-0.04$, $t=0.89$)

Independent variables	Quantity （$R^2=0.495$）		Quality （$R^2=0.452$）	
	Path coefficient	t-statistic	Path coefficient	t-statistic
Rewards in reputation system for quantity	0.13**	2.72	0.07	1.47
Rewards in reputation system for quality	-0.04	0.89	-0.06	1.23
Learning	0.18**	3.26	0.15*	2.15
Enjoy helping	0.33***	6.34	0.14[+]	1.83
Knowledge self-efficacy (control variable)	0.31***	5.762	0.49***	9.95
Note: [+]p<0.1; * p<0.05; ** p<0.01; *** p<0.001				

Table 2. SmartPLS results

6   DISCUSSION

Several interesting findings can be derived from this study. To begin with, the significant effect of rewards in reputation system for quantity on knowledge contribution quantity proves the capability of reputation system to act not only as technical risk reducer but also as incentive mechanism, or external regulation in virtual communities, which is rarely explored in previous literature. We observe that in online Q&A communities, a large part of rewards in reputation system target quantity of knowledge contribution. Judging from this study's results, the community developers' efforts have paid off as those rewards have successfully driven more knowledge contribution. However, the insignificant relationship between rewards in reputation systems for quality and knowledge contribution quality also reveals some problems associated with this kind of rewards. There are several possible explanations. The first is that since the variety of rewards targeting quality is not as many as those for quantity, knowledge contributors are not effectively motivated to contribute high quality knowledge.

If this is the case, community designers should spend more time and energy in developing more effective rewards targeting knowledge contribution quality. Another explanation is that this kind of rewards is simply not capable of encouraging high quality contribution since community users regard them too trivial to spend more cognitive efforts. This may also be attributed to the nature of external regulation. Research on knowledge sharing in organizational setting shows that financial incentives can artificially inflate knowledge contribution quantity, however, there is no guarantee for the value of share knowledge (Cabrera & Cabrera 2002). If this is true, developers should not waste their efforts in designing this kind of rewards target to quality. There are definitely many other explanations, for example, those rewards work for some participants but not for others. Which explanation is true is still unclear, which makes it an interesting topic for future research.

The finding that learning motive can significantly boost both knowledge contribution quality and quantity highlights the importance of learning in the context of online Q&A communities. Given its importance, it is surprising that this motive is not well discussed in previous literature on knowledge sharing in virtual communities. When talking about internalized extrinsic motivation, previous research usually focus on ego-related factors such as reputation (Tiwana & Bush 2005; Wasko & Faraj 2005), neglecting the important fact that participants actually want to learn something when contributing knowledge. Clary et al. (1998)'s study, concur this finding by showing that in voluntary activities, which share great similarity with this context in that participants in both situations help others for no monetary return, people wish to get the chance to exercise their knowledge, skill and ability apart from just helping others.

An interesting finding of this study is that enjoy helping only exerts marginal effect on the quality of knowledge contribution. This finding slightly challenges the self-determination theory, which states that intrinsic motivation leads to high performance as the internal joy of performing the activity drives individuals to spend more effort (Deci & Ryan 1985). One possible explanation for the weak effect is that since the context is non-work-related, participants tend to be worm hearted but quite relaxed. It implies that they might care more about the act of helping others than really providing valid information. Indeed, research show that emotional support is as much important as content information in this kind of community (Kim et al. 2007). Similar finding can also be found in Wasko and Faraj (2005)'s study that shows enjoy helping has marginal effect on helpfulness of contribution. It may be possible that in online context, intrinsic motivation is not sufficient to generate high quality knowledge contribution; other factors such as learning play a more important role.

7 IMPLICATIONS AND LIMITATIONS

7.1 Theoretical implication

This study makes several important theoretical implications to knowledge sharing literature as well as motivation theory. First and foremost, it distinguishes online Q&A communities from PVCs and identifies the drivers of knowledge contribution in the new context, thereby extending our understanding of virtual community. Particularly, it advances our understanding of reputation system by proving that it is capable of acting as incentive mechanism to boost knowledge contribution quantity apart from its traditional role of risker reducers. Meanwhile, this study demonstrates that learning plays a very important role in the context of online Q&A community as it can effectively facilitate both quantity and quality of knowledge contribution.

Second, it shows that the monolithic view of knowledge contribution is inaccurate. Drivers of knowledge contribution actually have different effect on the two important aspects of knowledge contribution and more importantly, the underlying mechanisms of the effects are different. Therefore, future research should be more specific when they examine the construct of knowledge contribution.

Finally, the study also contributes to our understanding of the motivation theory, self-determination theory, by showing that in this context intrinsic motivation is only marginally associated with performance. There may be some contingencies, such as context, that can make this established relationship unstable.

7.2   Practical implication

Besides theoretical implications, this paper also yields vital practical implication for practitioners, especially the developers of online Q&A communities. The first message is that the implementation of rewards in reputation system in recognition of community users' knowledge contribution is partially effective. As this research show that the rewards for quantity can effectively enhance knowledge contribution quantity, developers should spend more effort in developing more attractive rewards of this kind to ensure the contribution quantity of the community. As to the rewards targeting knowledge contribution quality, since its effect proves insignificant, developers should be more cautious when developing and maintaining such rewards, so as to avoid wasting effort.

The second implication is that since learning demonstrates a significant driver of both quantity and quality of knowledge contribution, developers should try their best to cater for their users. More specifically, they should maintain and further reinforce their positioning of the community as a nice place to learn. For example, besides the regular Q&A module, they can add some other modules that broadcast useful knowledge or provide some embedded tools to facilitate users' learning process in the community.

7.3   Limitations

Despite the contributions, this study has several limitations. First, this study is done in the context of a specific type of virtual community, online Q&A community. Due to the large variety of virtual communities nowadays, whether the results can be generalized to other types of communities is still questionable. Second, given the large size of the online Q&A community we investigated, it is quite difficult to get random sample of community users. However, we have a quite large sample (N=367); hopefully this can partially alleviate this concern. Moreover, since there is only one item measuring the construct "rewards in reputation for quality" we cannot assess its validity. This may also explain why we failed to detect a positive relationship between this construct and knowledge contribution quality. Finally, due to the scope of this study, in discussing the drivers of knowledge contribution, we mainly focus on individual motivational factors, but have not included other factors such as environmental factor like environmental trust (Hsu et al. 2007) and interpersonal factors such as social capital (Nahapiet & Ghoshal 1998).

8   CONCLUSION

Online Q&A communities emerge as a big business success and also an interesting research context for researchers. This study, leveraging on the prominent social psychology theory, self-determination theory, sets out to understand what drives participants to contribute knowledge freely. Specially, we treat quantity and quality as two crucial aspects of knowledge contribution and conceptualize the different underlying mechanism of motivational factors in influencing quantity and quality respectively. Results show that rewards in reputation system targeting quantity can effectively boost knowledge sharing quantity while rewards for quality do not lead not high quality knowledge contribution. Learning is revealed as a crucial motivational factor in the context as it is positively related with both aspects of knowledge contribution. Finally, enjoy helping is weakly related with knowledge contribution quality and strongly associated with knowledge contribution quantity. Besides theoretical importance, study boasts high practical significance as practitioners can learn a lot about how to design online Q&A communities, such as spending more energy in developing more attractive rewards targeting knowledge contribution quantity in the reputation system.

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APPENDIX A

Construct	Item wording and code	Source
Rewards in reputation system for quantity	•I answer questions to gain more "experience points" in this online Q&A community. •I answer questions to gain more "virtual wealth" in this online Q&A community. •I answer questions to gain higher level in this online Q&A community.	• Developped based on Kankanhalli, et al.(2005)
Rewards in reputation system for quality	•I answer questions to gain higher best answer rate in this online Q&A community.	
Learning	•I can maintain my current understanding about certain topics by answering questions in this online Q&A community. •I get the chance to exercise my current knowledge by answering questions in this online Q&A community. •I can explore my strengths by answering questions this online Q&A community. •I can gain further understanding about certain topics by answering questions in this online Q&A community. •I can practice my critical thinking by answering questions in this online Q&A community.	• Nam, et al.(2009) • Clary, et al.(1998) •Developed • Yu, Jiang, & Chan (2007)
Enjoy helping	•I enjoy sharing knowledge with other users in this online Q&A community. •I enjoy helping other users by answering questions in this online Q&A community. •It feels good to help someone else by answering questions in this online Q&A community. •I feel happy when I help other members answer their questions in this online Q&A community.	• Kankanhalli, et al. (2005)
Quantity of knowledge contribution	•I often help other users by answering questions in this online Q&A community. •I take an active part in this online Q&A community. •I have often contributed knowledge to this online Q&A community. •I have often shared knowledge by answering questions with other members of this online Q&A community.	• Ma & Agarwal (2007) and Yu, et al.(forthcoming)
Quality of knowledge contribution	• Overall, I think the answers I contributed are of high quality. •The answers I contributed are relevant to the questions. •The answers I contributed are timely. •The answers I contributed are reliable. •The answers I contributed are easy to understand. •The answers I contributed are accurate. •The answers I contributed are complete.	• Developed • Chiu, et al.(2006)
Knowledge self-efficacy	•I have confidence in my ability to provide knowledge that others users in this online Q&A community consider valuable. •I have the expertise needed to provide valuable knowledge others users in this online Q&A community.	(Kankanhalli et al. 2005)

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