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**WHY DO PEOPLE SHARE KNOWLEDGE IN ONLINE
SOCIAL Q&A COMMUNITIES?**



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2017

ABSTRACT

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Jyväskylä: University of Jyväskylä, 2017, 62 p.

Information Systems, Master's Thesis

Supervisor: Yixin Zhang

As there is increasing volume of knowledge with the development of technology and human intelligence, it is a fast and efficient way for individuals to get knowledge from others' sharing. Therefore, it is of significant importance to understand why people are willing to share their knowledge and in this paper the context of online social Q&A communities are discussed. A measurement model is established to test variables from the perspectives of intrinsic motivation, extrinsic motivation, personal variables, members' perceptions about the community, factors that may discourage knowledge contribution. 12 variables including reputation, expected associations, self-efficacy, norm of reciprocity, use of self-presentation, enjoying helping, attention, trust, identification/commitment, loss of knowledge power, codification effort and cyber-bullying have been discussed and analyzed to investigate their impacts on individual's perceived knowledge contribution as well as the quantity and quality of their actual knowledge sharing behavior. Survey data and empirical data were collected and combined for analysis with 269 complete responses. In addition, individual differences including gender, age, duration, status, education and tenure are taken into consideration in the structural model using PLS technique. Interesting findings as well as theoretical and practical implications are discussed at last.

Keywords: knowledge sharing, intrinsic motivators, extrinsic motivators, contextual variables, negative factors

PREFACE

Those days (nearly 2 years) spent in Finland were quite remarkable because I experienced many new things here and learnt to think about things that I would never care before. Writing Master thesis was a nice learning process that brought me deeper insights on knowledge sharing, a good mentor as well as some friends.

My master topic was decided on September 2016 after having a nice talk with Dr. Yixin Zhang, who became my supervisor later on. It was time consuming to find out what topic were my interest and the specific research goals and questions kept changing when I started collecting information. Additionally, to collect data of Zhihu users' information, I learnt Python after class in about 2 months and crawled data successfully at last with the help of some public APIs and also got Python programming advice from Dr. Shuaiqiang Wang. It was also nice that I learnt how to use Stata and SmartPLS to analyze data and build models.

I thank all the respondents who made this happen for devoting their time to answer my little questionnaires. I would also thank those who helped me double check and test my questionnaire designs and those who helped in sending part of those massive invitation messages. You all contributed massively to my thesis and graduation.

Special thanks to my supervisor Yixin Zhang for your encouraging guidance and support all the way along. You were always so nice and patient to answer my questions step by step and you knew how to think about things from others' perspectives. Moreover, you, as a good example, taught me to be strict with details in academics and be generous and kind to others in life. Most importantly, what I learnt from you was to hold a positive attitude towards life and always trying my best.

I am also grateful for all the encouragement and support I have gotten from my family. I thank you all for believing in me and supporting my decision to study in Finland. Last but not the least, I would thank Huang who encouraged me and accompanied me all the way along. I would always be grateful for having you being my side.

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1. Introduction

Knowledge sharing and diffusion are continuously the interest of a large number of researches because of their significant roles in improving people's life and heritage. As the information technology has been developing so fast, the quantity of knowledge has increased significantly, getting an increasing number of people involved in the process of knowledge production and diffusion. There have been many studies on the topic of online virtual communities and a large number of factors are suggested from different aspects to explain why people are willing to share knowledge voluntarily. However, it becomes a challenge to keep community members' motivation to contribute knowledge in knowledge-centered online communities (Jin, Li, Zhong, & Zhai, 2015). Actually, it has been predicted by Fortune 500 companies that more than 31.5 billion dollars would be lost every year due to the fact that many knowledge sharing behaviors have not been successfully executed and maintained (Wang & Noe, 2010). Therefore, it is of great significance to understand the motivation behind the behavior of community members such as participating virtual activities, sharing knowledge and develop loyalty to the community.

It has been proven that knowledge is a valuable resource for organizational growth and it offers opportunity for company to keep its competitive advantage in changeable environments. However, most companies do not own all required knowledge inside the organization, thus they need to ask for help from outside entities (Anand, Glick, & Manz, 2002). One helpful method is to access external knowledge through knowledge sharing systems in electronic communication networks which is quick and global. The study of enterprise knowledge sharing system is relatively mature and attracts quiet a lot attention both in academic and business fields. However, there is still space for improvement in terms of individual's knowledge sharing behavior in social Q&A communities based on current studies. There are some obvious differences between enterprise Q&A systems and online social Q&A communities. First of all, members in online social Q&A communities have the right to participate or quit based on their interests in certain topic area while employees are to some extent forced to use the enterprise Q&A systems due to the organizational policy or strategy. In addition, unlike most enterprise knowledge sharing systems which usually employ reputation-ranking mechanisms or financial rewards to promote knowledge

contribution, members in online social Q&A communities are independent and ask for no reward. Moreover, compared with other social media such as Facebook where the social networks are based on acquaintances, the relationships among members of social Q&A communities are weak because most of them are strangers to each other. In this paper, the research context is in online social Q&A communities, where the contributions are voluntary and the members have weaker social ties.

Knowledge sharing is a behavior of helping others with solving problems, suggesting ideas or implementing policies or procedures (Wang & Noe, 2010) in a self-organizing, open activity system focused on a shared practice that exists primarily through computer-mediated communication (Wasko & Faraj, 2005). People in networks of practice may not know each other nor do they expect to meet face to face (Brown & Duguid, 2002). Usoro et al. (2007) defined knowledge sharing as a communicating process to provide and acquire knowledge taking place among participants. Indeed, the communication can take place using both verbal and non-verbal mechanisms, with or without the use of technology (Usoro et al., 2007).

In terms of knowledge contribution, some previous studies have adopted surveys (Wasko & Faraj, 2005; Ma & Agarwal, 2013; Chiu, Hsu, & Wang, 2006; Chou, 2010; Hsu, 2007; Lin, Hung, & Chen, 2009; Bock & Kim, 2001; Lin, 2007; Shen, Yu, & Khalifa, 2010; Kankanhalli, Tan, & Wei, 2005; Chai, Das, & Rao, 2011; Alexandra & Peter, 2009; Yu, Jiang, & Chan, 2011) or empirical data analysis (Jin et al., 2015; Goes, Guo, & Lin, 2016; Zhao, Detlor, & Connelly, 2016; Jae & Lee, 2008; Khansa et al., 2015; Hendriks 1999) to understand knowledge contribution. Generally speaking, most of the prior studies have investigated in the motivators of such behavior, but only few have mentioned the negative factors on affecting knowledge sharing behavior. This study aims to address the following research question from both sides: What factors may influence users' knowledge contribution behaviors in online Q&A communities?

This paper will begin by reviewing relevant prior work in the knowledge sharing research literature. Specifically, I examine the frameworks and factors that may influence individuals' knowledge sharing behavior and relevant theories. Hypotheses are then developed in the following section, proposing relationships between various factors and knowledge contribution. Next, the hypothesized effects of knowledge sharing are empirically examined using partial least squares as an analytical technique involving 269 users of a social Q&A community. In addition to the data collected through survey, data were also crawled from the online community's websites for modeling testing. The results and discussion of the measurement model and structural model are then presented. Lastly practical and theoretical implications are discussed.

2. Theoretical background

Generally speaking, several mainstream theories were frequently used in previous studies to explain individual's knowledge contribution behavior: theory of reasoned action, social cognitive theory, social capital theory and social exchange theory. For instance, Chou (2010) employed the concept of self-efficacy and outcome expectations which are standing at the core of social cognitive theory to understand how individual differences affect the foregoing motivation of individuals' knowledge contribution behavior. Chiu, Hsu, and Wang (2006) added social capital theory combined with the social cognitive theory to construct a model for investigating people's knowledge sharing motivation by analyzing structural dimension, relational dimension and cognitive dimension. Jin et al. (2015) integrated social cognitive theory, social capital theory and social exchange theory together to explore whether factors like identity communication, peer recognition, the group-size effect and social learning have impacts on users' continuously knowledge contribution behavior. Theory of reasoned action has also been used combining with other theories for explaining the motivational factors why people share knowledge with strangers (Wang & Noe, 2012; Bock & Kim, 2001; Lin, 2007). There are some other theories such as theory of collective action, social psychology theory, social identity theory, social presence theory, self-categorization theory, goal setting and status hierarchy theories and so on (Wasko & Faraj, 2005; Ma & Agarwal, 2013; Shen, Yu, & Khalifa, 2010; Goes, Guo, & Lin, 2016) being used to explore the potential factors that have effects on individuals' knowledge sharing behavior. In this paper, the four mainstream theories would be briefly explained with their main ideas and how they are related with knowledge sharing behaviors.

2.1 Theory of reasoned action

The Theory of reasoned action has been applied in many fields to explain attitude and behavior. This theory posits that individual behavior is determined by behavioral intentions, which is a belief that performing a particular behavior would lead to certain outcome (Madden, Ellen, & Ajzen, 1992). Specifically, individuals' behavioral intention is determined by their

attitude toward performing certain behavior and their subjective norm associated with the behavior (Montaho & Kasprzyk, 2008). Attitude is a predisposition to show favorable or unfavorable manner towards a given object (Chau & Hu, 2001). In the Theory of Reasoned Action, attitude is determined by individual's beliefs and the evaluations of behavioral outcomes. In other words, individuals who hold positive attitude towards outcome will have a positive attitude toward the behavior and further perform the behavior (Montaho & Kasprzyk, 2008). The subjective norm is determined by the normative beliefs, which is whether the important referents think that they should perform the behavior or not (Rao & Troshani, 2007). For instance, a individual who believes that certain important people approve the behavior to be performed and could meet the referents' expectations will lead to a positive subjective norm (Montaho & Kasprzyk, 2008). Both extrinsic and intrinsic motivators are considered as the salient determinants of individuals' intentions towards knowledge sharing according to the research model by Lin (2007) which integrates the belief-attitude-intention relationship of theory of reasoned action..

2.2 Social cognitive theory

Social cognitive theory (SCT) has been widely used in information systems area to explain the relationship between personal cognition and Internet related behaviors. According to SCT, human motivation and action are extensively regulated by forethought, which includes expectations of certain outcomes result from a specific action (Luszczynska & Schwarzer, 2005). Particularly, self-efficacy and outcome expectations are standing at the core of the social cognitive theory. In social cognitive theory, self-efficacy reflects one's level of belief about his or her own capabilities to execute certain behavior successfully within a given context (Stajkovic & Luthans, 2003). In other words, self-efficacy expectations are influenced by the subjective perceptions of personal and situation factors instead of the direct impact of objective reality. Personal outcome expectations emphasize individuals' expectations such as gaining respects and recognitions, getting friendships, or enhancing cooperation with others (Hsu, Ju, Yen, & Chang, 2007).

Previous researches based on the Social Cognitive Theory have ignored the effects of social network and studies in online virtue community lightweight the importance of personal cognition. However, both personal cognition and social network should be taken into consideration when trying to understand the phenomenon that people spend time and effort on knowledge sharing in online social Q&A communities. Admittedly, Social Cognitive Theory alone pays little attention to the resources embedded

within the social network and the effects of them. Therefore, the Social Capital Theory is adopted to supplement the Social Cognitive Theory.

2.3 Social capital theory

Social capital theory indicates that individual's relationships in the network and all sorts of resources within it as social capital would have significant influence on knowledge sharing behavior (Chou, 2010). Trust and cooperation, which are considered to be the core elements of social capital, can be developed through people who interact repeatedly within a community (DiClemente, Crosby, & Kegler, 2009). It has been generally agreed that the more one uses social capital, the more one produces (Cox, 1995). In addition, social capital has been divided into three categories by Nahapiet and Ghoshal (1998): structural, relational (relationships by interactions) and cognitive (resources). Specifically, structural dimension of social capital refers to the general pattern of connections between individuals, which is who you reach and how you reach them (Burt, 1992). Relational dimension refers to particular relations individuals have, such as respect and friendship, which have impact on individuals' behavior (Nahapiet & Ghoshal, 1998b). Those key assets created by relationships include trust (Fukuyama, 1995), obligations and expectations (Burt, 1992), and identification (Håkansson & Shenota, 1995). The cognitive dimension refers to resources that provide shared representations, interpretations as so on among actors (Nahapiet & Ghoshal, 1998). Social capital concepts have been used to explain many pro-social behaviors that human or financial capital cannot explain (Coleman, 1990), for example, in the context of individual knowledge sharing behavior.

2.4 Social exchange theory

Social exchange theory focuses on intrinsic rewards instead of extrinsic benefits which are emphasized by economic exchange theory. It is suggested that social exchange "tends to engender feelings of belonging, personal obligation, gratitude, trust and loyalty" (Jin et al., 2015). Cook, Cheshire, Rice, and Nakagawa (2013) find that there are relationships between social exchange theory and theories of social status, influence, social networks, fairness, coalition formation, solidarity, trust, affect, and emotion. It is mentioned by Cropanzano and Mitchell (2005) that reciprocity, altruism, group gain and so on are the rules of exchange, among which reciprocity are

primarily focused by organizational sciences. There are six different types of exchange resources: love, status, information, money, goods and services (E. Foa & U. Foa, 1980). Particularly, knowledge and attention are the exchange objects in social virtual communities, especially attention which is a scarce resource in online social media are expected as a reward (Cowen & Lanham, 2007).

3. Factors affecting knowledge sharing and hypothesis development

Different researchers study the motivation of knowledge contribution behavior from different perspectives, mainly by analyzing data from either survey or programming based empirical activities. Findings are rich and the results may even be different with the same factors being investigated.

Motivations could be divided into different categories according to different criterions. Ryan and Deci (2000) think that there are two main kinds of motivation called extrinsic and intrinsic motivation. Specifically, extrinsic motivations are the drivers that make people to act in certain way to achieve some external rewards (Venkatesh, 2000), while intrinsic motivation relates to certain internal satisfaction such as pride, enjoyment or challenge that involve individuals to perform a behavior (Ryan & Deci, 2000). A framework of motivations for knowledge sharing has been put out by Chang and Chuang (2011) from the perspective of social capital theory and individual motivations. And Lin, Hung and Chen (2009) developed a model to test the effects of contextual factors and personal perceptions of knowledge sharing on knowledge contribution behaviors.

Moreover, different factors are taken into consideration in terms of explaining knowledge sharing behavior and sometimes different results appear with the same variables in different researches. For example, the norm of reciprocity, interpersonal trust, knowledge sharing self-efficacy, and perceived relative advantage are found to have significant affect on knowledge sharing behavior in professional virtual communities (Chen & Hung, 2010). Specifically, trust is found to have positive impact on knowledge sharing behavior by affecting self-efficacy, perceived relative advantage and perceived compatibility (Lin, Hung, & Chen, 2009). However, Lin et al. (2009) hold the opposite opinion with Chen and Hung (2010) suggesting that the norm of reciprocity seems to have no significant relationship with knowledge contribution behavior.

While there are still some studies that hold similar opinions in certain perspective. For instance, it is found that perceived trustworthiness which can be seen from how colleagues may do with sensitive information could affect the decision of knowledge sharing (Andrews & Delahaye, 2000).

Similarly Chowdhury (2005) found that the existence of trust could facilitate knowledge sharing and it is considered to be a key variable for the success of on-line environment (Corritore, Kracher, & Wiedenbeck, 2003).

Additionally, there are some other variables that are found to be interesting and significantly related to individual's knowledge sharing behavior. For instance, community-related outcome expectations and personal outcome expectations have been investigated by Chiu et al. (2006), who found that the former factor is significantly important for knowledge sharing behavior when considering both quality and quantity, while the latter factor has a negative but insignificant effect on knowledge sharing in terms of quantity. Moreover, social interaction ties, reciprocity, and identification are found to be positively related to individuals' quantity of knowledge sharing (Chiu et al., 2006) and loss of knowledge power seems have no effect on people's intention to share knowledge (Kankanhalli, Tan, & Wei, 2005). The summary of main literatures in the field of knowledge sharing in the context of individual contribution is show in table 8 in Appendix 1.

Based on the mentioned theories above and previous literature, a framework is suggested as shown in figure 1 to explain what kind of factors may affect individuals' behavior of knowledge sharing.

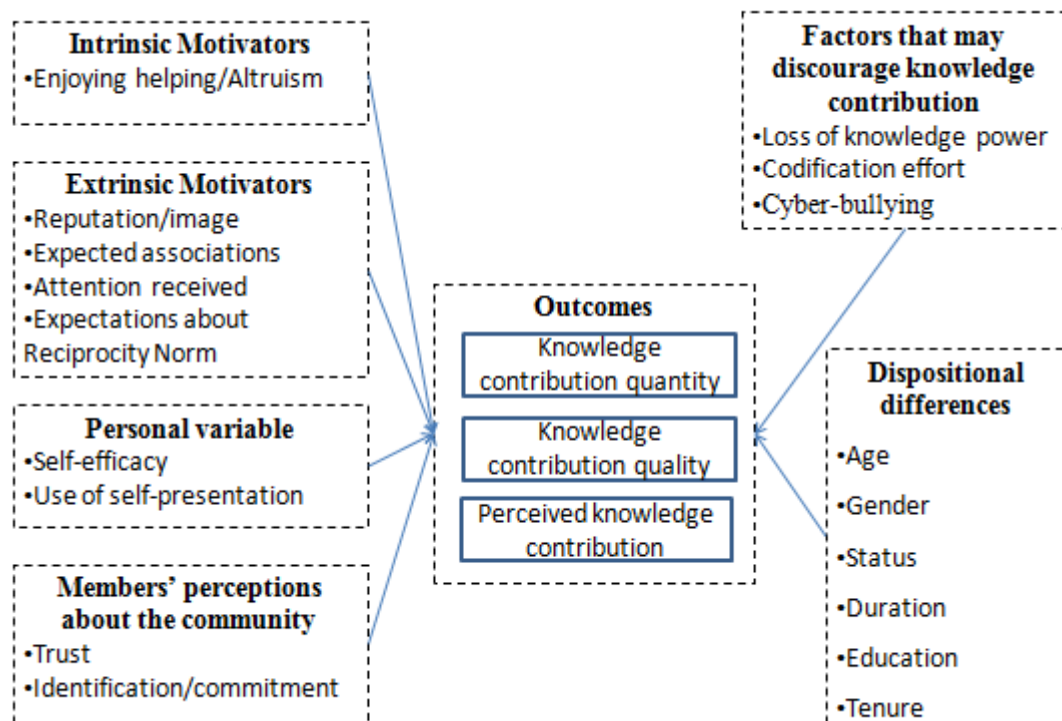


Figure 1 Framework of the Model

3.1 Intrinsic motivator

3.1.1. Enjoying helping / altruism

Individuals may answer questions in social Q & A sites simply because they gain enjoyment from helping others (Wasko & Faraj, 2005), which is derived from the concept of altruism expecting nothing in return (Krebs, 1975; Smith, 1981). Enjoyment is considered to be a psychic reward of helping others from the perspective of the single-spot interaction (Blau, 1964). It has been shown in previous research that individuals are motivated to share knowledge intrinsically since it is a challenge or pleasure to solve problems, and because they enjoy helping others (Ba et al., 2001; Constant et al., 1994). Satisfaction is obtained by sharing knowledge if it is behaved altruistically (Wasko & Faraj, 2000). In addition, a lot of knowledge contributors admit that they enjoy the experience of sharing knowledge with others and there are also empirical studies support the positive connection between individual's enjoying helping and knowledge contribution behavior (Wasko & Faraj, 2005; Kankanhalli et al., 2005). Therefore, we propose the following hypothesis:

H1. An online social Q&A community member's enjoying helping is positively related to knowledge contribution. The more the member enjoys helping others, the more likely he/she will contribute knowledge.

3.2 Extrinsic motivators

Individuals may conduct a behavior due to their expectations of some gains, benefits, and favorable outcomes. In the context of knowledge sharing, outcomes like gaining reputation with profession and obtaining social associations with other entities are considered to be the most obvious and beneficial motivators.

3.2.1 Reputation / image building

Reputation is essential for people to achieve and maintain status among a group of people (Jones, Hesterly, & Borgatti, 1997). It has been shown in previous research that sharing knowledge frequently and intelligently improves one's reputation (Lakhani & Von Hippel, 2003), which in turn motivates individual to participate more actively (Donath, 1999). In addition, Stewart (2005) proved that individual's profession would be extended if reputation is gained in online community. Individuals may obtain respect

(Constant et al., 1994) and a better image by contributing knowledge since it shows others that they have valuable expertise (Ba et al., 2001).

The primary motivation of people sharing knowledge is to be viewed as knowledgeable and skilled (Butler, Sproull, Kiesler, & Kraut, 2003). Therefore, individuals perceive that it would enhance one's reputation by sharing knowledge and it is enjoyable to help others in some degree (Wasko & Faraj, 2005). The term "image motive" is used by Yu, Jiang, and Chan (2011) to describe the desire of individuals to build a positive image by contributing knowledge in problem-solving virtual communities. Status and respect are considered to be the social rewards for those who get involved in the social interactions from the view of social exchange theory (Blau, 1964). Moreover, the desire for images like status and respect tends to be a powerful motivator and control for encouraging cooperation and helping others in online social communities. Therefore, we conclude the following hypothesis:

H2. An online social Q&A community member's reputation/image expectancy is positively related to knowledge contribution. The more the member expects to receive reputational benefits, the more likely he/she will contribute knowledge.

3.2.2 Expected associations

Social association is considered to provide approach for reaching information and resource (Tsai & Ghoshal, 1998). It has been indicated that network ties providing access to resources is the basic idea of Social Capital Theory (Nahapiet & Ghoshal, 1998). Specifically, social association means the degree of the relationship, which is a combination of the amount of time used and the frequency of communication with each other in the online social communities (Chiu et al., 2006). The greater the frequency of communication and the more information exchanged, the tighter social ties would be obtained among exchange parties (Ring & Van De Ven, 1994). Moreover, it has been supported by some empirical research that social association provides opportunity for exchanging and combining resources such as knowledge (Tsai & Ghoshal, 1998) in a cost-effective way. For instance, the individual would feel an obligation to reciprocate if he or she receives an initial offer of knowledge from other members in the community. A trustworthy and exchange relationship would be built if the individual who received help reciprocate properly. Therefore, both extrinsic and intrinsic benefits would be obtained through the expected associations, which assume that people would have a more positive attitude toward knowledge sharing if they could improve relationships with others in the community by sharing their knowledge. Accordingly, H3 is as follows:

H3. An online social Q&A community member's expected associations are positively related to knowledge contribution. The more the member expects to develop associations, the more likely he/she will contribute knowledge.

3.2.3 Attention received

The rapid development of technology nowadays makes information and ideas being available much easier, and this lead to the scarcity of attention. It has been indicated that there is a competition among knowledge contributors for recipients' attention. For example, Twitter posts (Rui & Whinston, 2012) and video upload on YouTube (Huberman, Subrahmanyam, Romero, & Wu, 2009) are inspired by getting more attention from the audience. Rui and Whinston (2012) find that how much attention individuals would obtain from other members determines the contribution of a Twitter user. It has been pointed out that attention is required by any kind of information that needs to be understood and consumed (Davenport & Beck, 2013). Specifically, people expect to get feedback from other peer members about their contribution when they provide an idea or suggestion. Attention especially that with positive feedback is likely to contribute to the continuing participation of sharing knowledge in the future (Brzozowski, Sandholm, & Hogg, 2009). Thus the hypothesis is as follows:

H4. An online social Q&A community member's pursuit of attention is positively related to knowledge contribution. The more the member expects to receive attention from others, the more likely he/she will contribute knowledge.

3.2.4 Expectations about reciprocity norm

Reciprocity is the behavior where individual reacts similarly to given actions (Fehr & Gächter, 2000). Individuals reciprocate by returning the favor from others to keep the exchange activity ongoing (Chen & Hung, 2010). It has been found by many researchers that individuals who always answer other member's questions tend to get more active answers and discussion from others in the community when they ask a question (Rheingold, 2000). Thus, it is indicated that individuals would be motivated to help others for anticipated reciprocity in social Q&A sites (Zhao, Detlor, & Connelly, 2016). Newton (2001) notices that the norm of reciprocity plays an essential role in building social trust in the initial stage of a relationship. It is also supported by Berg, Dickhaut and McCabe (1995) that reciprocity as one of the basic factors of human behaviors, has great effect on the trust which is extended in an anonymous party. And reciprocal altruism which contributes to a higher level of cooperation is considered to explain human sociality sufficiently (Gintis, 2000).

Falk and Fischbacher (2006) indicated that reciprocity is essentially significant in affecting human behavior. Specifically, individuals reward kind and punish unkind actions according to the theory of reciprocity they propose. Both the consequences and intentions of such an action are taken into consideration in terms of kindness. For example, one person must believe the other's intentions if he or she wants to reciprocate kindness with kindness (Dufwenberg & Kirchsteiger, 2004). In this paper, the norm of reciprocity indicates individuals' belief that present knowledge contribution would result in their request for knowledge being met in the future. Accordingly, the hypothesis is as follows:

H5. An online social Q&A community member's norm of reciprocity is positively related to knowledge contribution. The more the member expects others to return his/her favor, the more likely he/she will contribute knowledge.

3.3 Personal variables

People's behaviors vary due to their different backgrounds, personalities, pursuits and so on. In the context of knowledge sharing, perspectives of personal self-efficacy, norm of reciprocity, perceived identity verification, use of self-presentation, enjoying helping, perceived compatibility and attention pursuit would be discussed in this paper based on previous literatures.

3.3.1 Self efficacy

It is proven that some individuals are motivated to share knowledge due to the demand for challenges instead of external encouragement or pressure (Ryan & Deci, 2000), and this make them feel competent and proud of their knowledge (Deci, Koestner, & Ryan, 1999). Self efficacy, which would be increased by completing challenging task (Stajkovic & Luthans, 2003), is not only related to the actual skills individual has, but also how confident people feel about their skills to perform expected behavior (Bandura, 1986). Self-efficacy is a kind of self-valuation which affects people about what to do, how much effort to make and how long to persist when facing with obstacles (Hsu et al., 2007). It has been supported by several studies that the intention of knowledge contribution would increase if individuals have a positive judgment on his contribution (Bock & Kim, 2002). Hence, people who have higher knowledge self-efficacy are more likely to contribute knowledge in virtual communities. On the other side, individuals may refuse to contribute knowledge with lower self efficacy since they think their contribution cannot affect the community in a positive way. People would be motivated to share

knowledge by answering others' questions in online communities in order to increase their self-efficacy and obtain confidence about their knowledge and ability (Kankanhalli et al., 2005). Hence, the following hypothesis is proposed:

H6. An online social Q&A community member's self efficacy is positively related to knowledge contribution. The stronger self-efficacy beliefs the member has, the more likely he/she will contribute knowledge.

3.3.2 Use of self-presentation

Previous studies have found supportive evidence for the importance of identity communication for communication in online context. First of all, knowledge seekers are likely to perceive the knowledge to be more useful with high source credibility (Sussman & Siegal, 2003). Hence, the knowledge exchange would be less efficient and difficult to adopt if the identity of the knowledge contributors are unknown. Moreover, it has been found that people with similar interests and experiences are more likely to communicate with each other and form relationships (Newcomb, 1961).

Individuals present their identities in order to achieve a shared understanding by conveying the information of their experiences, status, interests etc. The term "self-presentation" has been employed to express the behavior of showing personal information in the context of online social community. It has been found that providing personal information is a significant motivation for contributing knowledge since it reflects the extent to which people trust the community (Hoffman, Novak, & Peralta, 1999). A large number of previous studies indicate that trust has a positive relation with people's loyalty toward the community, which positively affects members' continuous participation (Xia, Huang, Duan, & Whinston, 2012). In addition, self-presentation is likely to enhance one's perceived verification by allowing others viewing their identity information (Ma & Agarwal, 2014). Moreover, self-presentation makes it possible that the gained reputation in online community can prove the expertise they possess in real life (Golder & Donath, 2004). Finally, the use of self-presentation indicates a higher level of intention to participate in the community. It has been proven by many studies that behavior is positively impacted by intention (Jin et al., 2015). As a consequence, it is expected that individuals who use more self-presentation information tend to keep relationship with the community for a longer time and will contribute knowledge consistently. Therefore, we come up with the following hypotheses:

H7. An online social Q&A community member's use of self-presentation is positively related to knowledge contribution. The deeper usage of self-representation the member has, the more likely he/she will contribute knowledge.

3.4 Members' perceptions about the community

Contextual variables are also important factors that influence people's knowledge sharing behavior. In this paper, trust and identification/commitment are discussed as members' perceptions about the community.

3.4.1 Trust

Trust in a social community context is a set of beliefs that others will not take advantage of the shared knowledge (Gefen, Karahanna, & Straub, 2003), which means that members would behave dependently (Kumar, Scheer, & Steenkamp, 1995) and appropriately from our perspectives (Misztal, 1996). In other words, trust is a belief on others' kindness, moral principles and abilities (Mayer, Davis, & Schoorman, 1995; Gefen et al., 2003). Several prior studies have adopted the term "generalized trust" to indicate the belief in others' good intent, competence, and reliability in the context of knowledge contributing (Putnam, 1993; Kankanhalli et al., 2005). Hsu et al. (2007) divide trust into three stages: economy-base trust at the beginning, knowledge-based trust as the relationship develops, and finally identification-based trust. In the context of virtual community where members are relatively invisible, thus there is no guarantee that all the participants would behave as expected (Ridings, Gefen, & Arinze, 2002). Therefore, trust is especially important for virtual communities since it makes members feel more safe and open to interact with others (Butler & Cantrell, 1994) and reduces some unfavorable and opportunistic behaviors (Luhmann, 1979). Hence, trust is crucially important for sustaining the continuity of virtual communities.

It has been supported by many studies that trust plays an essential role in affecting knowledge sharing (Ridings et al., 2002) and the effectiveness of contribution knowledge (Williams, 2001). Blau (1964) also indicates that the quality of knowledge contribution is enhanced by trust, on which a good exchange relationship is based. It has also been supported by Nahapiet and Ghoshal (1998) that people are more willing to be involved in the cooperative interaction where there is trust, which is the basic requirement for cooperation (Tsai & Ghoshal, 1998) and effective knowledge exchange (Adler, 2001). Otherwise, people may think that others may take advantage of their knowledge if there is weak trust or no trust. For instance, consultants at Ernst and Young refuse to share knowledge since there is no trust existing between parties (Markus, 2001). Accordingly, the hypothesis is as follows:

H8. The trusting atmosphere in an online social Q&A community is positively related to knowledge contribution. The more trustworthy the member perceives the other community members as, the more likely he/she will contribute knowledge.

3.4.2 Identification/commitment

Identification is created when the interests of individuals and the community merge (Johnson et al. 1999). It has been found that people are more willing to make effort in sharing knowledge when there is strong identification because they care about the community outcomes (Constant et al 1996). Identification consists of three parts according to the previous literature: value similarity, community membership and the loyalty toward the community (Kankanhalli et al., 2005). Specifically, value similarity refers to the level of which the goals and interests of community members merge. Community membership indicates the extent to which members are linked with each other within the community. Loyalty reflects the degree to which members support and defend the community. It has been proven that identification plays a vital role in knowledge sharing behavior (Chiu et al., 2006) and it reflects one's willingness to keep the relationship in a virtual community (Dholakia, Bagozzi, & Pearo, 2004).

It has been indicated that the sense of belonging would result in emotional involvement or affective commitment to the virtual community (Dholakia et al., 2004). Moreover, committed members are said to be more intrinsically motivated (such as enjoyment) to contribute knowledge (Yu et al., 2011). Therefore, we conclude the following hypothesis:

H9. Member's identification/commitment in an online social Q&A community is positively related to knowledge contribution. The more the member identifies with the community, the more likely he/she will contribute knowledge.

3.5 Factors that may discourage knowledge contribution

There are also some factors that would reduce people's willingness to share knowledge in the online social Q&A communities. Variables including loss of knowledge power, codification effort and cyber-bullying are considered to be very important in stopping individuals from sharing knowledge.

3.5.1 Loss of knowledge power

It has been pointed out by previous literature that loss of power is one of the barriers to contributing knowledge. People may be afraid of losing their

power if their knowledge is not unique and known by others, since knowledge is considered to be a source of power (Gray, 2001; Thibaut & Kelley, 1986). It is reasonable that people hold their knowledge instead of sharing when more benefit is perceived to obtain (Davenport & Prusak, 1998). However, it has been suggested by Kankanhalli et al. (2005) that losing knowledge power may not be as significant as expected in deterring sharing knowledge if there are strong norms and most members are seen to be sharing knowledge. Therefore, we come up with the following hypotheses to test if people would stop sharing knowledge when considering the loss of their knowledge power:

H10. Loss of knowledge power is negatively related to the online social Q&A community member's knowledge contribution. The more the member perceives he/she may lose knowledge power, the less likely he/she will contribute knowledge.

3.5.2 Codification effort

Contributing knowledge to online Q&A communities involves codification, which requires time and effort (Markus, 2001). Orlikowski (1992) states that opportunity cost of codifying knowledge has become a factor that many consultants avoid because of needed time and effort. In addition, knowledge contributor may need more time on following-up requests for explanation and assistance from the knowledge recipients (Goodman & Darr, 1998). Therefore, there is a negative relationship between codification effort and knowledge contribution. However, the relationship is said to vary when the generalized trust is different in the community. For instance, if the generalized trust is strong, which contributes to the belief in a good intent of others (Putnam, 1993), people would believe that their knowledge would not be used without appreciation. To test if there is any relationship between codification effort and knowledge sharing behavior, we propose the following hypothesis:

H11. Codification effort is negatively related to an online social Q&A community member's knowledge contribution. The more codification efforts the member expects to spend, the less likely he/she will contribute knowledge.

3.5.3 Cyber-bullying

It has been pointed out that some people don't want to share because they are afraid of being criticized or belittled of what they are going to post, which would in turn to make them feel that their contributions are neither important nor accurate (Ardichvili, Page, & Wentling, 2003).

Cyber bullying occurs when offenders send harmful and disparaging content to someone, or to a public platform that is visible to many other

users in electronic communities (Hinduja & Patchin, 2008). Offending has been defined as using rude or nasty comments to embarrass or harass someone on the Internet (Ybarra & Mitchell, 2004).

It has been found that cyber bullying is most common in website comments especially for those random people only known online and least common on sites like Facebook (Whittaker & Kowalski, 2014). This may be caused by anonymity which makes people to do cyber bullying (Kowalski, Giumetti, Schroeder, & Lattanner, 2014) that they are not willing to do and say directly in front of others (Postmes & Spears, 1998). Therefore, the phenomenon that cyber bullying occurs most frequently in comments and forum indicates that anonymity may be a motivator of cyber aggression since those sites are completely anonymous or allowing fake name. Thus we come up with the following hypothesis:

H12. Cyber-bullying is negatively related to an online social Q&A community member's knowledge contribution. The more cyber-bullying the member encounters, the less likely he/she will contribute knowledge.

3.6 Dispositional differences

It helps in strategic utilization of virtual communities by understanding the gender-based differences in the motivation for knowledge sharing (Chai, Das, & Rao, 2011). It has been found that women and men behave very differently in terms of using the Internet (Banerjee et al., 2005). For instance, men use the Internet mainly to play games, read news and perform net bank, whereas women use the Internet mainly to communicate and do online shopping. In addition, gender difference has also shown in knowledge management systems. For example, men tend to use the knowledge management systems more frequently than women in general. And female tends to use interpersonal and socialization strategies to acquire knowledge (Taylor, 2004).

It shows that female users pay much more attention to reciprocity and social ties than male users, and those factors play significant role in their knowledge sharing. Interestingly, male users seem to care much more about privacy compared with female when deciding to share or not. Therefore, in this paper, we will check if it varies according to gender the degree of how the mentioned factors influence individual's knowledge contribution behavior. Similarly, some other individual-level differences including age, education, student or work status, frequency of community usages and tenure with the community are also included in the model.

4. Methodology

4.1 Study context and sample

Data was collected using an automatic crawling Python program from a popular Q&A website in China called Zhihu where questions are created, answered, edited and organized by the community of its users. Zhihu has an Alexa Traffic Ranks of 33rd in China and 183rd globally, having 92% of its visitors in China.

Fig 2 illustrates the interface of a Zhihu member's homepage. There are information about the member's personal information, participation information and feedback information. Specifically, personal information includes name used in this community, self-description sentence, education, work experience etc. This part of information is not a must to fill although Zhihu community encourages everyone to complete the information. Participation information reflects whether the member is active in the community by showing the number of questions asked and answers provided etc. Lastly, the feedback information mainly reflects how other members in this community response to his or her interaction, such as votes of thanking and votes for usefulness.

Since there are about 65,000,000 registered users in Zhihu, it is difficult to crawl all the data of those members. Therefore, we adopted snowball sampling method, which is a widely adopted sampling approach. IS scholars also adopt this sampling methods when studying a large population, such as social ties and user content generation and online product reviews (Zeng & Wei, 2013).

We started with a seed, Yuandong Tian (labeling as Level 1), (<https://www.zhihu.com/people/tian-yuan-dong/>), who is an expert in artifact intelligence. He was chosen as a seed, as we assume that people who get involved in this field may provide answers that are more knowledge related instead of just talking about personal feelings and opinions. Then we crawled data of the seed user's followees (those Tian follows, labeling as Level 2) and the followees' followees (labeling as Level 3) since individuals are more likely to follow those who are relatively more knowledgeable in certain field. In addition, we also collected the seed user's followers (those

who follow Tian, labeling as Level 0) in order to know the general knowledge contribution behavior of ordinary people. By Feb 24th 2017, we collected a sum of 5377 registered users. After sending invitation messages to those users, it had been found that the completed responses were far from enough. Thus we crawled another user, Shiti and his followees (<https://www.zhihu.com/people/stephenhky/answers>). He is a contributor in the field on physics. We sent invitation messages to the sample to invite them fill the questionnaire and eventually there were 269 full responses in total.



Figure 2 Screenshot of a Zhihu Member's Homepage

We crawled information including the user's user name, the link to the user's homepage, User ID, the headline and description the user apply to describe about himself/herself, the total number of questions they asked, the total number of answers they provide, and the total number of thanks and votes he/she received from other users for the answers he/she provided, the number of articles and collections he/she shared, the number of columns and topics he or she is following, the information of their education (school and major) and work experience (company and occupation), location, the number of followees, the number of followers, and the earliest date and the latest date he or she provided an answer. And for each answer he or she provided, we collected the specific number of thanks, votes and comments respectively. Then we calculated the maximum, minimum, median, mean and standard deviation for the number of thanks, votes and comments they received.

In addition to the objective data collected from the users' profile page, we also adopted the survey methodology. We designed a questionnaire including the variables that are likely to have influence on people's knowledge sharing behavior. In the invitation for survey, each of those users was assigned a unique invitation number, and they needed to fill in the invitation number in the questionnaire. In this way, we can match their questionnaire responses with the object data crawled from their Zhihu pages. An example of invitation message is provided in APPENDIX 3.

4.2 Operationalization of research variables

The survey measures for the study were mainly based on previous published studies. All research variables were measured using multi-item scales and the actual items used in the survey are presented in table 9 in APPENDIX 2. Scales for reputation were adapted from those developed by Wasko and Faraj (2005), while expected association was measured following the recommendations of Bock and Kim (2001). In addition, scales to measure self-efficacy, norm of reciprocity and trust were developed using ideas from Lin, Hung, and Chen (2009), while use of self-presentation and knowledge contribution were measured by items suggested by Ma and Agarwal (2007) and scales for measuring enjoying helping, loss of knowledge power and codification effort were adapted from Kankanhalli et al. (2005). Scales to measure identification/commitment were based on the four items supported by Chang and Chuang (2011). However, the scales for measuring attention and cyber-bullying were not found in any articles on the topic of knowledge sharing. Instead, those items were developed based on the conceptual discussions by some authors and were included in the survey.

To measure the dependent variable of knowledge contribution, we adopted three measures:

- 1) the self-reported knowledge contribution behaviors in the survey.
- 2) the quantity of knowledge contribution, as indicated by the total number of questions answered, shown on the user's Zhihu page.
- 3) the quality of knowledge contribution, as indicated by the total number of thanks and total number of votes the user received from other users for the answers he/she provided. The number of thanks and votes are collected from the users' Zhihu page.

Since the distributions of those numbers are overdispersed, we performed log transformation for the variables.

Sample characteristic are show in Table 1. It shows that 70.63% of the respondents are female while males only account for 79 out of the total 269. And most of the respondents are in the age between 21 and 30 years old

occupying 71.75% of the whole sample. In addition, it has been found that most of the users in Zhihu community are well educated since nearly half of the respondents obtain a Bachelor degree and the proportion of people who have Master and Doctor Degrees account for 27.51% and 15.24% respectively. Among those who gave completed responses, more than half of them are students and 61.74% of those who already worked have less than 5 years of work experience and 34% of them have a working period between 5 and 10 years. Besides, it is interesting to find that 45.35% of the respondents spend 1 to 5 hours every week in Zhihu community and 27.88% of them spend 6 to 10 hours per week there. Lastly, users who become a member of Zhihu community for 2-3 years and more than 3 years represent 30.86% and 34.94% respectively and 20 respondents forgot their tenure in Zhihu community.

Table 1 Sample Characteristics

Variables	Options	Freq.	Percent	missing
Gender	Female	190	70.63	0
	Male	79	29.37	
Age	< 21	31	11.52	0
	21-30	193	71.75	
	31-40	42	15.61	
	41-50	3	1.12	
Education	High school or below	13	4.83	0
	College	8	2.97	
	Bachelor	133	49.44	
	Master	74	27.51	
	Doctor	41	15.24	
Status	Student	142	52.79	0
	Already working	115	42.75	
	To be employed	4	1.49	
	Others	8	2.97	
Working period	<5 years	71	61.74	154
	5-10 years	34	29.57	
	11-15 years	5	4.35	
	>15 years	5	4.35	
Frequency	<1 hour	32	11.9	0
	1-5 hours	122	45.35	
	6-10 hours	75	27.88	
	11-20 hours	30	11.15	
	>20 hours	10	3.72	
Tenure with Zhihu	<1year	20	7.43	0
	1-2years	52	19.33	
	2-3years	83	30.86	
	>3years	94	34.94	

	forgot	20	7.43	
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In this paper, SmartPLS is used as a tool to establish the nomological validity of knowledge contribution with PLS, a latent structural equations modeling techniques. It is a component-based approach which requires minimal sample size and residual distributions (Agarwal & Karahanna, 2000). The analysis strategy is to establish a measurement model first to assess the psychometric properties of all scales of the confirmatory factor, and examine the structural relationships next using a structural model involving control variables such as age, gender, status, etc.

4.3 The measurement model

There are 12 variables with multiple indicator items being measured in the measurement model and the descriptive statistics for the constructs are shown in table 2. Item loadings, discriminant validity and internal consistency are used to assess the psychometric properties of the scales. Specifically, the results are considered acceptable if item loadings and internal consistencies are greater than 0.70 (Fornell & Larcker, 1981). As information shown in table 3, 4 and 5, scales used in this paper largely meet measuring requirement. All items except for one item in cyber-bullying (CB3), codification efforts (CE2) and reputation (REP3) have high loadings (>0.70) on their correspond constructs. In addition, the composite reliability and Cronbach's alpha shows that all constructs in this model have a good internal consistency with composite reliability range from 0.82 for codification effort to 0.96 for loss of knowledge power.

The discriminant validity could be assessed from the following two sides: (1) the discriminant validity is acceptable if indicators have higher loadings on their corresponding construct than on other constructs in the model; (2) the square root of the average variance extracted (AVE) is larger than the inter-construct correlations. It is obvious in table 3 that every indicator has higher loadings on their own constructs than on any others. Additionally, each construct has more variance with their own indicators than with any others. Therefore, it is evident that those constructs in the model obtain adequate internal consistency and discriminate validity of our conceptualization of knowledge contribution.

Table 2 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.
Reputation(REP)	269	4.8835	0.9827
Expected Associations(EA)	269	4.7494	1.0528
Self-Efficacy(SE)	269	5.2739	0.9009
Norm of Reciprocity(NR)	269	4.7770	1.1137
Use of Self-Presentation(USP)	269	4.4154	1.1385
Enjoy Helping(EH)	269	5.3520	1.0138
Attention(AT)	269	4.9740	0.9592
Trust(TST)	269	4.1190	1.2505
Identity/Commitment(IC)	269	4.0632	1.2262
Loss of Knowledge Power(LNP)	269	2.4746	1.0995
Codification Effort(CE)	269	4.1673	1.0489
Cyber-Bullying(CB)	269	4.4002	1.4685
<p>Notes: all constructs are seven-point scales with the anchors 1=Strongly disagree, 4=Neutral, 7=Strongly agree. Every variable is calculated using the average of indicators, for example, $REP = (REP1 + REP2 + REP3) / 3$</p>			

Table 3 Results of Factor Analysis

	AT	CB	CE	EA	EH	IC	KC	LNP	NR	REP	SE	TST	USP	kcQuantity	kcQuality
AT1	0.8964	0.1077	-0.0145	0.3910	0.4652	0.4279	0.4446	-0.1043	0.2496	0.5808	0.3036	0.1701	0.3552	0.2111	0.2959
AT2	0.7732	-0.0706	-0.1054	0.4844	0.5761	0.5500	0.3348	-0.1414	0.4351	0.5132	0.3574	0.3550	0.3990	0.0071	0.0189
AT3	0.9143	0.0031	-0.0444	0.4493	0.4927	0.4723	0.4241	-0.1384	0.2967	0.5404	0.4191	0.2872	0.3468	0.1111	0.1826
CB1	0.0558	0.9537	0.0249	-0.1133	0.0149	-0.1636	0.2624	-0.0326	-0.1281	-0.0270	0.0315	-0.2030	0.1050	0.3242	0.3931
CB2	0.0642	0.9512	0.0229	-0.1343	-0.0108	-0.1700	0.2620	-0.0636	-0.1262	-0.0217	0.0146	-0.2652	0.0868	0.3372	0.4441
CB3	-0.0893	0.6688	0.0660	-0.0342	-0.1334	-0.2139	0.1180	0.2663	-0.1462	-0.1424	-0.0271	-0.1992	-0.0070	0.1596	0.2008
CE1	-0.1012	-0.0482	0.8440	-0.0800	-0.2060	-0.1222	-0.2578	0.2514	-0.0708	-0.0937	-0.1078	-0.0297	-0.1134	-0.1210	-0.1158
CE2	0.0129	0.0783	0.4784	-0.0741	-0.0057	-0.0791	-0.0955	-0.0369	-0.1010	0.0241	0.0740	-0.1266	-0.0984	0.0577	0.1596
CE3	0.0109	0.1118	0.8041	0.0225	-0.0958	0.0072	-0.1427	0.3767	-0.0556	-0.0551	-0.0593	0.0212	-0.0696	-0.0690	-0.0533
CE4	0.0122	0.0858	0.7723	0.0127	-0.1133	-0.0218	-0.1544	0.3627	-0.0728	0.0287	-0.0885	-0.0316	-0.1067	-0.0500	-0.0027
EA1	0.4695	-0.0994	-0.0669	0.8294	0.4467	0.4913	0.2659	-0.0595	0.4146	0.4991	0.3594	0.3274	0.2439	-0.1264	-0.1432
EA2	0.3510	-0.1263	-0.0144	0.8712	0.3306	0.4011	0.1898	-0.0161	0.3793	0.3710	0.3321	0.2855	0.1987	-0.1699	-0.1859
EA3	0.3914	-0.1026	-0.0084	0.8308	0.3695	0.3518	0.2080	-0.0311	0.3729	0.4128	0.3487	0.2231	0.2311	-0.1210	-0.1351
EA4	0.3944	-0.0718	0.0050	0.7648	0.3270	0.4095	0.2004	0.0259	0.3016	0.4549	0.2757	0.2775	0.1602	-0.1145	-0.0942
EA5	0.3866	-0.0705	-0.0695	0.7222	0.2882	0.4056	0.1583	-0.1718	0.2725	0.3598	0.3128	0.1585	0.2243	-0.1198	-0.1036
EH1	0.5092	-0.0144	-0.2003	0.3936	0.8850	0.4966	0.4285	-0.1788	0.4170	0.4869	0.3406	0.3649	0.4629	0.1158	0.0658
EH2	0.4273	0.0490	-0.1513	0.3401	0.8725	0.3864	0.4319	-0.2070	0.3763	0.4087	0.3517	0.3679	0.4465	0.1063	0.0428
EH3	0.5586	-0.0625	-0.1637	0.4116	0.8952	0.5442	0.4313	-0.1165	0.4358	0.5352	0.3634	0.4073	0.5137	0.0364	-0.0145
EH4	0.5401	-0.0719	-0.1452	0.4299	0.9056	0.4988	0.4254	-0.1455	0.4907	0.5124	0.3627	0.4244	0.5100	0.0301	-0.0026
IC1	0.5246	-0.1416	-0.0662	0.4339	0.4722	0.8987	0.3619	0.0024	0.4076	0.4605	0.2156	0.4501	0.3899	0.0111	0.0086
IC2	0.4600	-0.1630	-0.0636	0.4919	0.4644	0.8930	0.2710	0.0120	0.4456	0.3887	0.1959	0.5100	0.3657	-0.0766	-0.1168

IC3	0.4232	-0.2255	-0.0697	0.4524	0.4638	0.8447	0.2220	-0.0406	0.4729	0.4049	0.1880	0.4764	0.3182	-0.0802	-0.1727
IC4	0.4816	-0.1711	-0.0768	0.4353	0.5036	0.8896	0.3338	-0.0031	0.4554	0.4542	0.1808	0.4472	0.3796	-0.0582	-0.1131
KC1	0.4224	0.1738	-0.1300	0.2906	0.4629	0.3374	0.7919	-0.0239	0.3146	0.3348	0.4225	0.2660	0.3671	0.2160	0.1886
KC2	0.4679	0.1517	-0.1849	0.2777	0.4216	0.4327	0.7654	0.0678	0.2247	0.3351	0.2398	0.2117	0.3990	0.3043	0.2901
KC3	0.2613	0.3096	-0.2645	0.0622	0.2872	0.0706	0.7927	-0.2500	0.0483	0.2342	0.3638	-0.0691	0.2639	0.3426	0.4045
KC4	0.3435	0.2108	-0.2173	0.1749	0.3607	0.2314	0.8503	-0.1348	0.1166	0.3209	0.3699	0.0427	0.3100	0.2766	0.3166
LNP1	-0.1460	0.0106	0.3373	-0.0924	-0.1497	-0.0528	-0.0673	0.9252	0.1017	-0.1018	-0.1962	0.0768	0.0464	-0.0116	-0.0562
LNP2	-0.1389	0.0261	0.3392	-0.0638	-0.1684	0.0019	-0.0996	0.9586	0.0955	-0.0895	-0.2157	0.0614	0.0076	-0.0128	-0.0444
LNP3	-0.1275	0.0043	0.3813	-0.0287	-0.1907	0.0132	-0.1082	0.9601	0.0863	-0.1050	-0.1945	0.0805	0.0031	-0.0720	-0.0919
NR1	0.3004	-0.0739	-0.0535	0.3992	0.4356	0.4519	0.2337	0.0387	0.8502	0.2690	0.2508	0.4001	0.3737	-0.0111	-0.0695
NR2	0.3080	-0.1886	-0.0939	0.4186	0.4702	0.4797	0.1725	0.0801	0.9097	0.3181	0.2875	0.4887	0.3971	-0.0864	-0.1880
NR3	0.2998	-0.1049	-0.0673	0.3114	0.3362	0.3635	0.1804	0.1318	0.8173	0.2253	0.2548	0.3658	0.3674	-0.0627	-0.1451
REP1	0.5535	-0.0371	-0.0939	0.4522	0.5346	0.4141	0.3553	-0.1384	0.3421	0.8808	0.4204	0.3083	0.3526	0.1139	0.1058
REP2	0.5954	-0.0298	-0.0317	0.4445	0.4264	0.4178	0.3439	-0.1013	0.1989	0.8949	0.3492	0.1168	0.3006	0.0780	0.1310
REP3	0.3472	-0.0897	-0.0115	0.4042	0.3679	0.3866	0.2180	0.0491	0.2462	0.6523	0.2213	0.2731	0.2189	-0.0679	-0.0774
SE1	0.3902	0.0381	-0.1178	0.3704	0.3815	0.1884	0.3931	-0.1630	0.2550	0.3804	0.8904	0.1534	0.2448	0.1322	0.1549
SE2	0.3402	0.0054	-0.0681	0.3276	0.3154	0.1620	0.3879	-0.1956	0.2224	0.3721	0.8879	0.0890	0.1932	0.1439	0.1496
SE3	0.3002	-0.0141	-0.0860	0.3411	0.3189	0.2289	0.3218	-0.1865	0.3355	0.3112	0.7584	0.1330	0.2971	0.0297	0.0026
TST1	0.4488	-0.2710	-0.0570	0.4152	0.5376	0.6410	0.2372	-0.0049	0.5825	0.4461	0.2173	0.7706	0.3999	-0.0489	-0.1221
TST2	0.1327	-0.2318	-0.0077	0.1991	0.2710	0.3589	0.0726	0.1034	0.3113	0.1039	0.0610	0.9105	0.2505	-0.1621	-0.2508
TST3	0.2198	-0.1717	-0.0051	0.2606	0.3800	0.4335	0.1021	0.0910	0.4254	0.1965	0.1237	0.9278	0.3320	-0.1325	-0.2139
USP1	0.3692	0.1231	-0.1129	0.1876	0.4320	0.3250	0.3859	0.0609	0.3275	0.3031	0.2021	0.3038	0.8454	0.0746	0.0321
USP2	0.2155	0.0275	-0.0374	0.2103	0.3657	0.3676	0.2520	0.1792	0.4303	0.2198	0.1557	0.3228	0.7227	-0.0394	-0.1381
USP3	0.2901	0.0399	-0.1359	0.2002	0.4537	0.2766	0.3185	-0.1477	0.3414	0.2549	0.2618	0.2867	0.7112	0.0681	0.0087
USP4	0.3387	0.0398	-0.0659	0.1991	0.3620	0.2860	0.2784	-0.0165	0.2448	0.3009	0.2105	0.1857	0.6988	0.0735	0.0418

log_answer_num	0.1485	0.3319	-0.1065	-0.1628	0.0821	-0.0553	0.3543	-0.0411	-0.0641	0.0774	0.1287	-0.1363	0.0668	1.0000	0.8385
log_thanks_num	0.2204	0.4118	-0.0884	-0.1678	0.0351	-0.0937	0.3722	-0.0727	-0.1509	0.1043	0.1331	-0.2188	0.0036	0.8352	0.9943
log_vote_num	0.2198	0.4243	-0.0733	-0.1660	0.0176	-0.1188	0.3660	-0.0709	-0.1653	0.0878	0.1313	-0.2378	-0.0171	0.8325	0.9945

Notes: REP= Reputation; EA=Expected Associations; SE=Self-Efficacy; NR=Norm of Reciprocity; USP=Use of Self-Presentation; EH=Enjoy Helping; AT= Attention; TST=Trust; IC= Identity/Commitment; LNP=Loss of Knowledge Power; CE=Codification Effort; CB=Cyber-Bullying; log_answer_num=log(answer_num +1); log_thanks_num=log(thanks_num+1); log_vote_num=log(vote_num+1); KCQuality=Quality of Knowledge Contribution; KCQuantity= Quantity of Knowledge Contribution.

Table 4 Inter-Construct Correlations

	AT	CE	CB	EH	EA	IC	KCQuality	KCQuantity	KC	LNP	NR	REP	SE	TST	USP
AT	1.0000														
CE	-0.0520	1.0000													
CB	0.0351	0.0356	1.0000												
EH	0.5712	-0.1860	-0.0271	1.0000											
EA	0.4943	-0.0383	-0.1191	0.4421	1.0000										
IC	0.5382	-0.0785	-0.1959	0.5406	0.5119	1.0000									
KCQuality	0.2213	-0.0812	0.4204	0.0264	-0.1678	-0.1069	1.0000								
KCQuantity	0.1485	-0.1065	0.3319	0.0821	-0.1628	-0.0553	0.8385	1.0000							
KC	0.4716	-0.2465	0.2612	0.4828	0.2569	0.3423	0.3712	0.3543	1.0000						
LNP	-0.1425	0.3761	0.0131	-0.1828	-0.0580	-0.0069	-0.0722	-0.0411	-0.1004	1.0000					
NR	0.3519	-0.0843	-0.1456	0.4826	0.4384	0.5029	-0.1591	-0.0641	0.2256	0.0977	1.0000				
REP	0.6300	-0.0635	-0.0522	0.5454	0.5218	0.4866	0.0965	0.0774	0.3852	-0.1047	0.3164	1.0000			
SE	0.4074	-0.1067	0.0146	0.3985	0.4056	0.2210	0.1329	0.1287	0.4358	-0.2117	0.3082	0.4202	1.0000		
TST	0.2891	-0.0240	-0.2542	0.4392	0.3221	0.5313	-0.2297	-0.1363	0.1484	0.0776	0.4887	0.2670	0.1453	1.0000	
USP	0.4137	-0.1239	0.0845	0.5428	0.2630	0.4142	-0.0069	0.0668	0.4217	0.0160	0.4415	0.3636	0.2796	0.3667	1.0000

Table 5 Quality Criteria

	AVE	Composite Reliability	Cronbachs Alpha
Attention	0.7458	0.8975	0.8347
Codification Effort	0.5461	0.8223	0.7563
Cyber-Bullying	0.7539	0.8997	0.8360
Enjoy Helping	0.7915	0.9382	0.9121
Expected Association	0.6487	0.9019	0.8643
Identity/Commitment	0.7775	0.9332	0.9048
KCQuality (Thx&Votes)	0.9889	0.9944	0.9888
KCQuantity(Answer_Num)	1.0000	1.0000	1.0000
Knowledge Contribution	0.6411	0.8771	0.8129
Loss Of Knowledge Power	0.8989	0.9639	0.9461
Norm Of Reciprocity	0.7395	0.8947	0.8228
Reputation	0.6674	0.8553	0.7577
Self-Efficacy	0.7188	0.8841	0.8050
Trust	0.7612	0.9048	0.8405
Use Of Self-Presentation	0.5578	0.8337	0.7356

4.4 The structural model

In order to test the factors in more contextual situation and eliminate the confounding due to individual difference, characteristics including individual's age, gender, education, status, duration and tenure are included combined with the measurement model to form a new structural model. In this PLS model, loadings of a construct can be used for a components factor analysis and path is represented by the standardized beta weights in the regression analysis.

As can be seen from Table 3, most of the constructs in the structural model are assessed by multiple indicators except quantity of knowledge contribution and those mentioned characteristics variables such as age and gender. Table 6 shows the total effects of all constructs in the model after doing Bootstrapping in SmartPLS. The model in SmartPLS looks like Figure 3 with indicators

hidden for clearer exposition. In addition, table 7 describes the summary of the tests. It is clear that attention has significant positive effect on the quantity and quality of individual knowledge contribution as well as their perceived knowledge contribution. However, it is interesting to find that codification effort has a negative influence on individual's perceived knowledge contribution but it has no effect on neither the quantity nor quality of knowledge contribution. Surprisingly, cyber-bully is found to be strongly positive related to knowledge contribution in all three ways. This may be explained by the phenomenon that the more people contributed, the larger likelihood one may get cyber-bully from others. This is not a causal relationship but a tendency phenomenon.

Moreover, it is interesting that enjoying helping and use of self-presentation are positively related to individual's perceived knowledge sharing behavior, but there is no significant relationship when combining with the actual quantity and quality of knowledge contribution. It is common that what people think is different from what people do, and that's why the objective and subjective data are joined together to check in this paper. Surprise to our expectation, the results show that expected association has significant negative effects on the quality and quantity of knowledge contribution. It may be explained that the higher expectation you hold, the easier you would get disappointed if the environment could not meet your expectation and this would lead to lower intention or motivation to share knowledge with others in the community. In addition, it is supported by the results that self-efficacy plays a significant role in promoting the quality of knowledge sharing and individual's perceived contribution to the community, but the effects on the quantity of knowledge contribution is not significant.

For those individual characteristic variables, it has been found that usage frequency and tenure with Zhihu both have significantly positive effects on the quantity and quality of knowledge contribution. However, age, gender, education and status do not show significant relationships with individual's knowledge sharing behavior. Additionally, it has been found that people in the community do not care about losing knowledge power and do not expect other user's reciprocity when they share knowledge. Interestingly, individual tends to show no expectation of gaining reputation in the community and do not care about if there is trust or commitment toward the environment and the people there.

Table 6 Total Effects

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (O/STERR)
Age -> KCQuality@Thx&Votes	0.0401	0.0399	0.0646	0.0646	0.6206
Age -> KCQuantity@Answer_Num	0.0544	0.0531	0.0685	0.0685	0.7938
Age -> Knowledge Contribution	0.0533	0.0554	0.0501	0.0501	1.0652
Tenure -> KCQuality@Thx&Votes	0.1264	0.1307	0.0540	0.0540	2.3418
Tenure -> KCQuantity@Answer_Num	0.1193	0.1226	0.0579	0.0579	2.0601
Tenure -> Knowledge Contribution	0.0872	0.0855	0.0454	0.0454	1.9196
Education -> KCQuality@Thx&Votes	0.0408	0.0387	0.0514	0.0514	0.7949
Education -> KCQuantity@Answer_Num	0.0259	0.0210	0.0582	0.0582	0.4451
Education -> Knowledge Contribution	-0.0107	-0.0142	0.0563	0.0563	0.1893
Gender -> KCQuality@Thx&Votes	0.0548	0.0548	0.0533	0.0533	1.0279
Gender -> KCQuantity@Answer_Num	-0.0385	-0.0367	0.0580	0.0580	0.6649
Gender -> Knowledge Contribution	-0.0402	-0.0403	0.0522	0.0522	0.7699
Status -> KCQuality@Thx&Votes	-0.0347	-0.0330	0.0540	0.0540	0.6431
Status -> KCQuantity@Answer_Num	0.0273	0.0287	0.0630	0.0630	0.4329
Status -> Knowledge Contribution	-0.0691	-0.0694	0.0543	0.0543	1.2734
Frequency -> KCQuality@Thx&Votes	0.1566	0.1560	0.0511	0.0511	3.0631
Frequency -> KCQuantity@Answer_Num	0.1458	0.1475	0.0586	0.0586	2.4876
Frequency -> Knowledge Contribution	0.0338	0.0391	0.0462	0.0462	0.7327
Attention -> KCQuality@Thx&Votes	0.3513	0.3507	0.0696	0.0696	5.0495
Attention -> KCQuantity@Answer_Num	0.1898	0.1857	0.0738	0.0738	2.5721
Attention -> Knowledge Contribution	0.1738	0.1697	0.0644	0.0644	2.7001
Codification Effort -> KCQuality@Thx&Votes	-0.0916	-0.0873	0.0832	0.0832	1.1018

Codification Effort -> KCQuantity@Answer_Num	-0.0909	-0.0893	0.0735	0.0735	1.2363
Codification Effort -> Knowledge Contribution	-0.2073	-0.1970	0.0675	0.0675	3.0709
Cyber-Bullying -> KCQuality@Thx&Votes	0.3209	0.3170	0.0499	0.0499	6.4315
Cyber-Bullying -> KCQuantity@Answer_Num	0.2509	0.2478	0.0579	0.0579	4.3339
Cyber-Bullying -> Knowledge Contribution	0.2488	0.2426	0.0502	0.0502	4.9542
Enjoy Helping -> KCQuality@Thx&Votes	0.0129	0.0071	0.0891	0.0891	0.1444
Enjoy Helping -> KCQuantity@Answer_Num	0.0828	0.0800	0.0989	0.0989	0.8369
Enjoy Helping -> Knowledge Contribution	0.2025	0.2025	0.0661	0.0661	3.0650
Expected Association -> KCQuality@Thx&Votes	-0.2799	-0.2788	0.0659	0.0659	4.2501
Expected Association -> KCQuantity@Answer_Num	-0.2865	-0.2894	0.0686	0.0686	4.1795
Expected Association -> Knowledge Contribution	-0.0578	-0.0599	0.0694	0.0694	0.8328
Identity/Commitment -> KCQuality@Thx&Votes	-0.0725	-0.0736	0.0749	0.0749	0.9687
Identity/Commitment -> KCQuantity@Answer_Num	-0.0301	-0.0317	0.0795	0.0795	0.3783
Identity/Commitment -> Knowledge Contribution	0.1461	0.1371	0.0737	0.0737	1.9814
Loss Of Knowledge Power -> KCQuality@Thx&Votes	0.0479	0.0462	0.0635	0.0635	0.7554
Loss Of Knowledge Power -> KCQuantity@Answer_Num	0.0488	0.0498	0.0657	0.0657	0.7421
Loss Of Knowledge Power -> Knowledge Contribution	0.0953	0.0801	0.0558	0.0558	1.7097
Norm Of Reciprocity -> KCQuality@Thx&Votes	-0.0601	-0.0562	0.0764	0.0764	0.7862
Norm Of Reciprocity -> KCQuantity@Answer_Num	-0.0110	-0.0104	0.0791	0.0791	0.1394
Norm Of Reciprocity -> Knowledge Contribution	-0.0910	-0.0851	0.0718	0.0718	1.2683
Reputation -> KCQuality@Thx&Votes	0.0614	0.0612	0.0788	0.0788	0.7793
Reputation -> KCQuantity@Answer_Num	0.0252	0.0265	0.0857	0.0857	0.2935

Reputation -> Knowledge Contribution	0.0048	0.0080	0.0698	0.0698	0.0683
Self-Efficacy -> KCQuality@Thx&Votes	0.1291	0.1234	0.0645	0.0645	2.0014
Self-Efficacy -> KCQuantity@Answer_Num	0.1059	0.1060	0.0646	0.0646	1.6379
Self-Efficacy -> Knowledge Contribution	0.2356	0.2344	0.0627	0.0627	3.7583
Trust -> KCQuality@Thx&Votes	-0.0941	-0.0950	0.0742	0.0742	1.2673
Trust -> KCQuantity@Answer_Num	-0.0649	-0.0613	0.0727	0.0727	0.8922
Trust -> Knowledge Contribution	-0.0327	-0.0371	0.0636	0.0636	0.5135
Use Of Self-Presentation -> KCQuality@Thx&Votes	-0.0974	-0.0884	0.0794	0.0794	1.2266
Use Of Self-Presentation -> KCQuantity@Answer_Num	-0.0159	-0.0117	0.0805	0.0805	0.1974
Use Of Self-Presentation -> Knowledge Contribution	0.1328	0.1392	0.0626	0.0626	2.1195

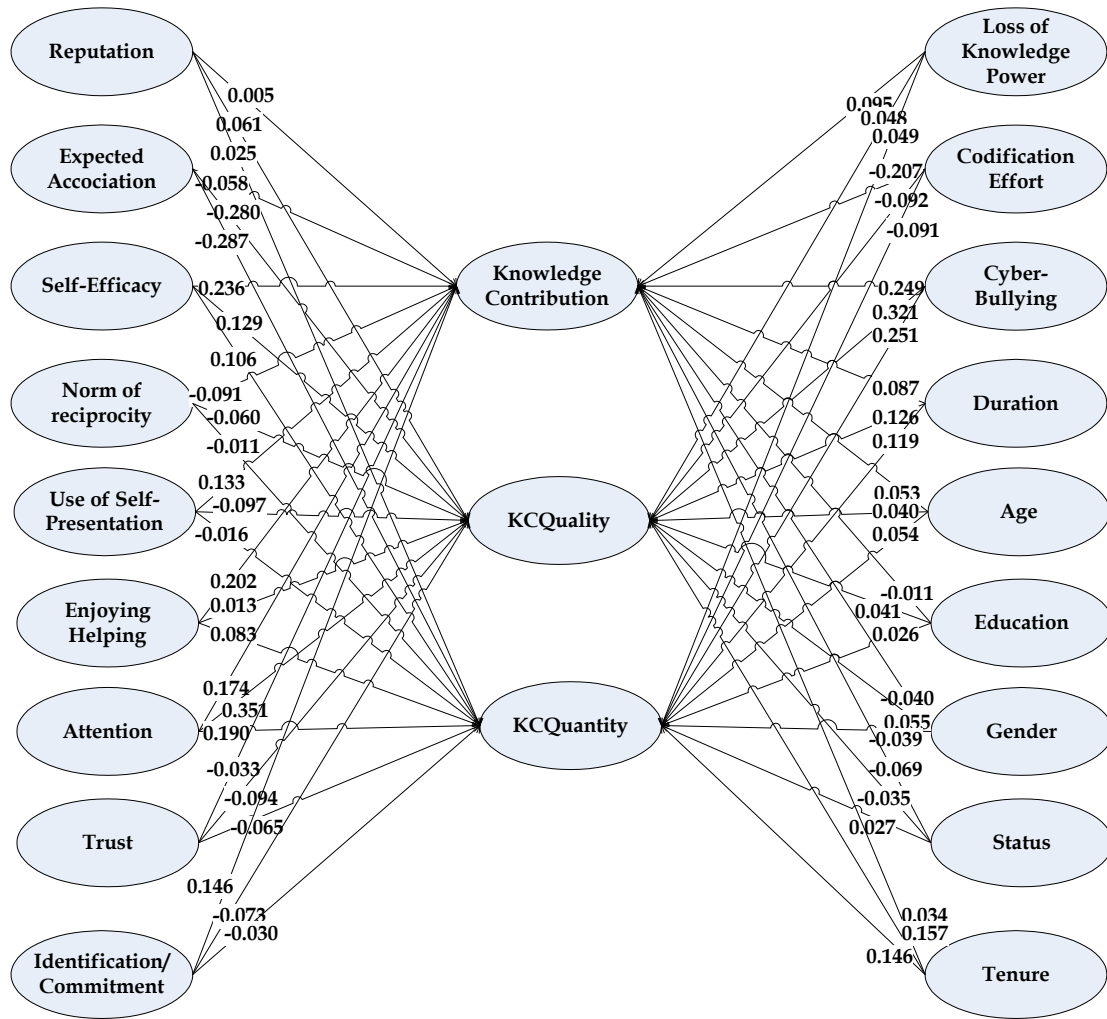


Figure 3 PLS model

Table 7 Summary of Hypothesis Tests

Hypotheses	Main idea	Supported by this research?
H1	<i>EH->kcquality</i>	NOT SIG
	<i>EH->kcquantity</i>	NOT SIG
	<i>EH->KC</i>	YES
H2	<i>REP->kcquality</i>	NOT SIG
	<i>REP->kcquantity</i>	NOT SIG
	<i>REP->KC</i>	NOT SIG
H3	<i>EA->kcquality</i>	SIG BUT OPPOSITE
	<i>EA->kcquantity</i>	SIG BUT OPPOSITE
	<i>EA->KC</i>	NOT SIG
H4	<i>AT->kcquality</i>	YES
	<i>AT->kcquantity</i>	YES
	<i>AT->KC</i>	YES
H5	<i>NR->kcquality</i>	NOT SIG
	<i>NR->kcquantity</i>	NOT SIG
	<i>NR->KC</i>	NOT SIG
H6	<i>SE->kcquality</i>	YES
	<i>SE->kcquantity</i>	NOT SIG
	<i>SE->KC</i>	YES
H7	<i>USP->kcquality</i>	NOT SIG
	<i>USP->kcquantity</i>	NOT SIG
	<i>USP->KC</i>	YES
H8	<i>TST->kcquality</i>	NOT SIG
	<i>TST->kcquantity</i>	NOT SIG
	<i>TST->KC</i>	NOT SIG
H9	<i>IC->kcquality</i>	NOT SIG
	<i>IC->kcquantity</i>	NOT SIG
	<i>IC->KC</i>	NOT SIG
H10	<i>LNP->kcquality</i>	NOT SIG
	<i>LNP->kcquantity</i>	NOT SIG
	<i>LNP->KC</i>	NOT SIG
H11	<i>CE->kcquality</i>	NOT SIG
	<i>CE->kcquantity</i>	NOT SIG
	<i>CE->KC</i>	YES
H12	<i>CB->kcquality</i>	SIG BUT OPPOSITE
	<i>CB->kcquantity</i>	SIG BUT OPPOSITE
	<i>CB->KC</i>	SIG BUT OPPOSITE
<p>Note: NOT SIG=not significant in this research; SIG BUT OPPOSITE=the result in this research is significant but opposite to the hypothesis; YES=the result in this research is significant and it support the original hypothesis</p>		

5. Limitations

There some limitations needed to be acknowledged within the contextual environment of online Q &A communities in this paper. First of all, it is suggested that both the respondents and the setting in which the study involves should be taken into consideration (Cook & Campbell, 1979). The setting for this study was a particular online social Q&A community in China called Zhihu and the respondents are the followers and followees of selected sample seeds for the convenience of getting a relatively larger dataset. The culture background may also be an influential factor when analyzing individual level phenomenon. Therefore, the behaviors of selected respondents are somehow limited. This may be improved in future work if there are some ways to get a large dataset more randomly and it would be better if multiple platforms are compared and analyzed instead of just one. This issue could also be addressed by replicated testing in various contexts to figure out the boundary settings of the model.

Additionally, the moderating effects of some variables should be further checked by comparing them in different models. Actually some tests were done to find the moderating effects but the results were not significant in this model and thus they were dropped. However, it would be of great significance to find some moderating effects in different models and figure out which variables are significantly related to the behavior of knowledge sharing and how it happens. For example, if individuals really enjoy helping, would they still share knowledge with others even though the codification effort is high?

Lastly, the results of this study are based on one single tool SmartPLS and one single modeling technique. It could be tested in future work if there are some other tools could be used for analyzing the data and if there is any difference when different modeling techniques are used with the same constructs in the model. Further study work should have a critical selection of analyzing tools and sample size since every tool has their own advantages and disadvantages. For instance, SmartPLS uses the path model to explain the relationship between the constructs and indicators and using loadings to explain if there some relationship between constructs. These are significant ways of offering an understandable picture and support for explaining the outcomes. However, the models in SmartPLS are always not perfect and complete due to the complexity of the reality which could not be shown exactly in one model (Sander & Teh, 2014). And it is mentioned by some author that PLS provides more accurate and valid results in testing model than other methods if the

sample size is small (below 250). Therefore, it is important to choose an appropriate tool and modeling technique taking sample size into consideration.

6. Implications and conclusions

This study was motivated by a broad interest in understanding why individual shares knowledge in online social Q&A communities. Specifically, factors that would motivate and discourage people to share knowledge are explained and analyzed. It has been found that there is little research focusing on factors that may have negative effect on knowledge contribution. This research is important since it offers a more systematic framework on sharing knowledge by considering both motivators and negative variables.

Despite the effort of investigating motivations behind users' knowledge sharing behavior, there are some limitations of previous work and some supplements were made in this research. For instance, there is no integrated model to conclude factors that influence members' knowledge contribution behavior by considering a wider range of perspective together (Wang & Noe, 2010) such as individual, contextual and negative motivations at the same time. In addition, the results are expected to be more accurate when a combination of empirical data and survey data is used to check motivations and obstacles from different points of view.

There are some implications of this research for both theory development and practice. In terms of theoretical side, this paper could be a reference for people who are interested in extending this topic related to knowledge sharing. For some constructs in the model that had been measured by some other researches, we have confirmed some of them and got different results for some others at the same time. For instance, our results support the argument of Kankanhalli et al. (2005) that the loss of knowledge power and reputation appear to not influence individual's knowledge sharing behavior. Additionally, this research supported the idea that self-efficacy and enjoy helping significantly influence knowledge contributors as many researchers proposed (Kankanhalli et al., 2005; Chen & Hung, 2010; Lin, 2007). However, different with Lin (2007) and Chang and Chuang (2011)'s finding about reciprocity that there is a positive relationship between reciprocity and knowledge contribution, this paper found that reciprocity has no significant impact on individual's knowledge sharing behavior. Moreover, Chang and Chuang (2011) found reputation, social interaction and trust had positive effects on the quality of knowledge contribution, while expected social association is found to have a significantly negative impacts on both the quantity and quality of knowledge contribution and trust is found to have no influence related to knowledge contribution.

Another theoretical contribution of this research is that attention is taken into consideration in this model. While to the best of our knowledge, there has been no any discussion about it in existing literatures related to the topic of knowledge sharing. The questionnaire items of attention were drawn based on the basic concepts of the construct. And it is encouraging that attention seems to have significantly positive influence on individual's perceived knowledge contribution and both the quantity and quality of their actual knowledge sharing behavior. Moreover, this research complements previous studies by combining survey data and objective data into analysis, which identifies that there are large differences between what people thought and what they actually did. This makes great contribution to current work on knowledge sharing field since most of the research done before only occupy either survey data or empirical data and few studies tried to combine multiple data sources. Besides, individual's characteristics including age, gender, education, status, duration and nature are tested to check if there is any influence on knowledge contribution. However, the moderating effects of those variables needed to further investigate in the future though duration and tenure are found to have positive impacts on the quantity and quality of knowledge contribution.

From the perspective of practice, this paper has some implications on community design and management in order to promote individual's knowledge sharing behavior in online social Q&A communities. For example, it is found that attention and self-efficacy are significant with individual's knowledge contribution, thus system designers may think of some functions to strengthen that people would get attention if they share knowledge in this community and encourage them so that they would be more confident in knowledge sharing. The results of this research indicate that people nowadays pay more attentions to their intrinsic needs instead of extrinsic motivators. Moreover, it would be helpful if the designers could use some new technologies (for example, voice to text transformation etc.) to reduce the codification effort of sharing knowledge. Besides, although those who share more get more cyber-bullying, it does not mean that cyber-bullying is encouraged in this community. The correlations between cyber bullying and knowledge contribution shall be interpreted with cautious. It is likely that those who share more knowledge become more noteworthy and are attacked. The community should pay more attention to increase people's trust and commitment towards this community so that they would stay longer and contribute more even though we found in our research that there is no significantly direct impact of them.

In conclusion, the goal of this paper is to enrich our understanding of individual's knowledge sharing behavior in online social Q & A communities. We examined variables from the perspectives of intrinsic motivation, extrinsic motivation, personal variables, members' perceptions about the community, factors that may discourage knowledge contribution. We tested their effects on individual's perceived knowledge contribution and the quality and

quantity of actual knowledge sharing behaviors are analyzed using empirical data combined with survey data. This study has value for theory development as well as for practice. Some work still remains to be done and improved in order to give more critical results and implications in related field. We hope this study could be further extended by some researchers in the future.

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APPENDIX 1

Table 8 Summary of Main Literatures on Individual's Knowledge Sharing

Year	Author of study	Theory	Factors	Method
1999	Hendriks	Herzberg's Two-Factor Theory	Motivators(sense of achievement, responsibility, recognition of job done, operational autonomy, promotional opportunities, challenge of work); ICT	Empirical data analysis
2003	Sharratt & Usoro	None	The ease of use and perceived usefulness of the km system, trust, the perceived proximity of knowledge-sharing to career advancement, sense of community and perceived value congruence	Literature review
2004	Wasko, Faraj & Teigland	Theories Of Social Networks And Collective Action	Social controls(reputation, status, shunning) relational strength of ties, obligation, identification, generalized trust; individual motivations and resources	Literature review
2005	Wasko & Faraj	Theory Of Collective Action	Individual motivations and social capital	Survey
2005	Kankanhalli, Tan & Wei	Social Exchange Theory, Social Capital Theory	Intrinsic(knowledge self-efficacy and enjoyment in helping others);loss of knowledge power and codification effort ;contextual factors(generalized trust, pro-sharing norms, and identification);extrinsic benefits(reciprocity and organizational reward)	Survey

2006	Chiu, Hsu & Wang	Social Capital And Social Cognitive Theories	Personal outcome expectation, community-related outcome expectation, social interaction ties, trust, norm of reciprocity, identification, shared language, shared vision	Survey(Blueshop)
2007	Hsu et al.	Social Cognitive Theory	Trust, self-efficacy, outcome expectations(personal and environmental influences)	Web-based survey(yahoo groups and professional associations)
2007	Uoro et al.	Theory Of Generalized Reciprocity; Theory Of Situated Learning	Competence, integrity and benevolence of trust	Survey
2009	Lin, Hung & Chen	Social Cognitive Theory	Contextual factors(norm of reciprocity and trust), personal perceptions of knowledge sharing (knowledge sharing self-efficacy, perceived relative advantage, and perceived compatibility) community loyalty	Online survey: three PVCs in Taiwan: programmer-club, blue-shop, and pure(test using structural equation modeling)
2009	Alexandra & Peter	Signaling Theory (Quality)And Reinforcement Theory	Duration, transparency and restrictiveness of the validation process	Survey
2010	Chou	Social Cognitive Theory; Km-Related Theory	Computer self-efficacy; computer anxiety; personal innovativeness in it; performance expectancy; perceived identity verification ; satisfaction;	Survey(two online communities: the electronic engineering times in Taiwan and China)

2010	Chen & Hung	Social Cognitive Theory And Social Exchange Theory	Contextual factors(norm of reciprocity and interpersonal trust), personal factors (knowledge sharing self-efficacy, perceived relative advantage, and perceived compatibility)	Online survey(1.several knowledge discussion forums hosted by Pchome online, 2.several PVCs members)
2010	Shen , Yu & Khalifa	Social Identity Theory And Social Presence Theory, Self-Categorization Theory	Awareness, affective social presence, cognitive social presence	Online survey(4 different VCs of interest)
2011	Chang & Chuang	Social Capital Theory And Individual Motivation	Structural dimension: social interaction relational dimension: trust, identification, reciprocity cognitive dimension: shared language	Survey;
2011	Chai, Das & Rao	Social Capital Theory; Social Role Theory	Trust, reciprocity; social ties, information privacy; gender	Survey
2011	Yu, Jiang & Chan	Expectancy-Value Theory	Egoistic (enjoyment of helping others, reciprocity, self-enhancement, image) altruistic(moral obligation, advance virtual communities) social(perceived pro-sharing norms, perceived salience of social identity)	Online survey
2013	Ma & Agarwal	Social Psychology Theory	Virtual Copresence, persistent labeling, self-presentation and deep profiling(is proposed to enhance perceived identity verification, which thereafter promotes satisfaction and knowledge contribution)	Survey(data from two online communities:quitnet,is300)

2013	Yan & Davison	Self-Perception Theory	Enjoyment in helping others, sense of self-worth; flow(perceived enjoyment, attention focus)	Belief elicitation, a pilot survey, and a large-scale survey
2015	Jin, Li, Zhong & Zhai	Social Cognitive Theory, Social Capital Theory And Social Exchange Theory	Identity communication(self-presentation), peer recognition, the group-size effect, and social learning	Empirical data analysis
2015	Faraj,Kudaravalli & Wasko	Behavioral Approach	Sociability, structural social capital	Survey; data analysis
2015	Khansa Et Al.	Goal Setting Theory	Artifacts (e.g. Incentives), membership (e.g. Levels of membership and tenure), and habit (e.g. Past behavior).	Empirical data analysis
2016	Goes, Guo & Lin	Goal Setting And Status Hierarchy Theories	Approaching goals: the effect of distance attaining goals: the instantaneous effect of goal attainment. After goal attainment: the lure of the next goal hierarchical effect: comparison across ranks	Empirical data analysis
2016	Zhao, Detlor & Connelly	Attribution Theory And Theory Of Planned Behavior	Virtual org. Reward. Reciprocity, enjoyment in helping others, knowledge self-efficacy, attitude (active member or not)	Empirical data analysis

APPENDIX 2

Table 9 Questionnaire Items

Factors	Original Source	Original Questionnaire Items	Adopted Questionnaire Items	Translated Questionnaire Items In Chinese
Reputation/Image	Wasko & Faraj (2005)	<ol style="list-style-type: none"> 1. I earn respect from others by participating in the MB. 2. I feel that participation improves my status in the profession. 3. I participate in the MB to improve my reputation in the profession. 	<ol style="list-style-type: none"> 1. I earn respect from others by participating in the MB 2. I feel that participation improves my status in the profession 3. I participate in the MB to improve my reputation in the profession 	<p>通过和其他知乎成员分享知识，</p> <ol style="list-style-type: none"> 1. 我会获得其他成员的尊重。 2. 会提高我在知乎社区中的地位。 3. 能够提高我的专业声誉。
Expected Associations	Bock & Kim (2001)	<ol style="list-style-type: none"> 1. My knowledge sharing would strengthen the tie between me and existing members in the organization. 2. My knowledge sharing would get me well acquainted with new members in the organization. 3. My knowledge sharing would expand the scope of my associations with other members in the organization. 4. My knowledge sharing would draw smooth cooperation from able members in the future. 5. My knowledge sharing would make strong relationships with 	<ol style="list-style-type: none"> 1. My knowledge sharing would strengthen the tie between me and existing members in the organization. 2. My knowledge sharing would get me well acquainted with new members in the organization. 3. My knowledge sharing would expand the scope of my associations with other members in the organization. 4. My knowledge sharing would draw smooth cooperation from able members in the future. 	<p>在知乎社区分享知识可以</p> <ol style="list-style-type: none"> 1. 让我和现有的社区成员的关系更加紧密。 2. 让我和社区新成员熟悉起来。 3. 拓展我和其他社区成员的联系。 4. 让我和有能力的成员以后有顺利的合作。 5. 让社区中有共同兴趣的成员间建立紧密的联系。

		members who have common interests in the organization.	5. My knowledge sharing would make strong relationships with members who have common interests in the organization.	
Self-Efficacy	Lin,Hung &Chen(2009)	<ol style="list-style-type: none"> 1. I have confidence in my ability to provide knowledge that other members in this virtual community consider valuable. 2. I have the expertise, experiences, and insights needed to provide knowledge that is valuable for other members in this virtual community. 3. I have confidence in responding or adding comments to messages or articles posted by other members in this virtual community. 	<ol style="list-style-type: none"> 1. I have confidence in my ability to provide knowledge that other members in this virtual community consider valuable. 2. I have the expertise, experiences, and insights needed to provide knowledge that is valuable for other members in this virtual community. 3. I have confidence in responding or adding comments to messages or articles posted by other members in this virtual community. 	<ol style="list-style-type: none"> 1. 我有信心我提供的知识对其他社区成员来说是有价值的。 2. 我有所需的专业能力，经验以及洞察力来为其他成员提供有价值的知识。 3. 我有信心能对其他成员在知乎社区上发的文章或信息给予回应或评论。
Norm Of Reciprocity	Lin, Hung & Chen (2009)	<ol style="list-style-type: none"> 1. I know that other members will help me, so it's obligatory and fair to help other members in this virtual community. 2. When I share knowledge with other members, I believe that the members in this virtual community would help me if I need it. 3. When I share knowledge with 	<ol style="list-style-type: none"> 1. I know that other members will help me, so it's obligatory and fair to help other members in this virtual community. 2. When I share knowledge with other members, I believe that the members in this virtual community would help me if I need it. 	<p>当我和其他知乎成员分享知识时，</p> <ol style="list-style-type: none"> 1. 我知道其他知乎成员也会帮助我，所以帮助其他知乎成员是义务和公平的。 2. 我相信当我需要的时候，其他知乎成员也会给我帮助。

		other members, I believe that my queries for knowledge will be answered in the future in this virtual community.	3. When I share knowledge with other members, I believe that my queries for knowledge will be answered in the future in this virtual community.	3. 我相信我之后在知乎上提的问题将会得到回答。
Use Of Self-Presentation	Ma & Agarwal (2007)	<ol style="list-style-type: none"> 1. I tell my stories to other community members in this community. 2. I share my photos or other personal information with people from this community. 3. I express my opinions in my posts. 4. I present information about myself in my profile. 5. I use a special (or meaningful) signature in this community that differentiates me from others. 6. I use a special (meaningful) name or nickname in this community that differentiates me from others. 7. I let other community members visit my personal Web page. 	<ol style="list-style-type: none"> 1. I tell my stories to other community members in this community. 2. I share my photos or other personal information with people from this community. 3. I express my opinions in my posts. 4. I present information about myself in my profile. 5. I use my real name as the name in Zhihu community 6. I share my real education information in the virtual community. 7. I share my real working information in the virtual community 	<p>我在知乎社区会：</p> <ol style="list-style-type: none"> 1. 讲述自身经历。 2. 分享照片。 3. 在帖子里表达自己的观点。 4. 在个人资料中提供有关自己的信息。 5. 用自己的真实姓名作为知乎用户名 6. 发布我的真实受教育信息。 7. 发布我的真实工作信息。

Enjoying Helping	Kankanhalli, Tan, & Wei (2005)	<ol style="list-style-type: none"> 1. I enjoy sharing my knowledge with others through EKR's (EHLPI). 2. I enjoy helping others by sharing my knowledge through EKR's (EHLPI2). 3. It feels good to help someone else by sharing my knowledge through EKR's (EHLPI3). 4. Sharing my knowledge with others through EKR's gives me pleasure (EHLPI4). 	<ol style="list-style-type: none"> 1. I enjoy sharing my knowledge with others through Zhihu community. 2. I enjoy helping others by sharing my knowledge through Zhihu community. 3. It feels good to help someone else by sharing my knowledge through Zhihu community. 4. Sharing my knowledge with others through Zhihu community gives me pleasure 	<ol style="list-style-type: none"> 1. 我喜欢通过知乎社区分享知识。 2. 我喜欢通过在知乎社区分享知识帮助别人。 3. 通过知乎社区分享知识让我感觉良好。 4. 在知乎社区和他人分享知识给我带来快乐。
Attention	self-developed		<ol style="list-style-type: none"> 1. My knowledge sharing earns attention from other members in the virtual community 2. My knowledge sharing earns positive feedback from other members in the virtual community. 3. My knowledge sharing earns appreciation from other members in the virtual community 	<p>在知乎社区分享知识让我获得</p> <ol style="list-style-type: none"> 1. 其他成员的关注。 2. 正面的反馈。 3. 其他成员的欣赏。
Trust	Lin, Hung & Chen(2009)	<ol style="list-style-type: none"> 1. Members in this virtual community have reciprocal faith-based and trustworthy relationships. 2. Members in this virtual community will not take advantage of others even when a profitable opportunity arises. 	<ol style="list-style-type: none"> 1. Members in this virtual community have reciprocal faith-based and trustworthy relationships. 2. Members in this virtual community will not take advantage of others even when a profitable opportunity arises. 	<p>我相信知乎社区成员</p> <ol style="list-style-type: none"> 1. 值得相互信赖。 2. 不会利用他人，即使有取得利益的机会。 3. 总会遵守他们相互之间的承诺。

		3. Members in this virtual community always keep promises that they make to one another.	3. Members in this virtual community always keep promises that they make to one another.	
Identification/Commitment	Chang&Chuang(2011)	<ol style="list-style-type: none"> 1. I feel a sense of belonging toward the virtual community. 2. I have a feeling of togetherness or closeness in the virtual community. 3. I have a strong positive feeling toward the virtual community. 4. I am proud to be a member of the virtual community. 	<ol style="list-style-type: none"> 1. I feel a sense of belonging toward the virtual community. 2. I have a feeling of togetherness or closeness in the virtual community. 3. I have a strong positive feeling toward the virtual community. 4. I am proud to be a member of the virtual community. 	<ol style="list-style-type: none"> 1. 我对知乎社区有一种归属感。 2. 我在知乎社区有一种团结和亲密的感觉。 3. 我对知乎社区有强烈的好感。 4. 我为自己是知乎的一员而感到自豪。
Loss Of Knowledge Power	Kankanhalli, Tan, & Wei (2005)	<ol style="list-style-type: none"> 1. Sharing my knowledge through EKR makes me lose my unique value in the organization (L0KP1) 2. Sharing my knowledge through EKR makes me lose my power base in the organization (L0KP2) 3. Sharing my knowledge through EKR makes me lose my knowledge that makes me stand out with respect to others (L0KP3) 4. Sharing my knowledge through EKR makes me lose my knowledge that no one else has (L0KP4) 	<ol style="list-style-type: none"> 1. Sharing my knowledge through Zhihu community makes me lose my unique value in the organization 2. Sharing my knowledge through Zhihu community makes me lose my knowledge that makes me stand out with respect to others 3. Sharing my knowledge through Zhihu makes me lose my knowledge that no one else has. 	<p>在知乎上分享知识使我</p> <ol style="list-style-type: none"> 1. 失去了独特的价值。 2. 失去了让我脱颖而出的知识。 3. 失去了自己独有的知识。

Codification Effort	Kankanhalli, Tan, & Wei (2005)	<ol style="list-style-type: none"> 1. I do not have the time to enter my knowledge into EKR (CEFF1) 2. It is laborious to codify my knowledge into EKR (CEFF2) 3. The effort is high for me to codify my knowledge into EKR (CEFF3) 4. I am worried that if I share my knowledge through EKR, I will have to spend additional time answering follow up questions (CEFF4) 5. I am afraid that my submission to EKR will evoke additional clarifications or requests for assistance (CEFF5) 	<ol style="list-style-type: none"> 1. I do not have the time to enter my knowledge into Zhihu community 2. It is laborious to codify my knowledge into Zhihu community 3. I am worried that if I share my knowledge through Zhihu community, I will have to spend additional time answering follow up questions 4. I am afraid that my submission to Zhihu community will evoke additional clarifications or requests for assistance 	<ol style="list-style-type: none"> 1. 我没有时间把知识输入知乎平台。 2. 把我的知识输入知乎平台需要花力气。 3. 我担心在知乎上分享知识之后我还要用额外的时间来回答后续问题。 4. 我担心在知乎上分享知识之后，他人会请求我给出更多的解释或帮助。
Cyber-bullying	Self-developed		<ol style="list-style-type: none"> 1. I have received rude comments in the community when I share knowledge. 2. I have received nasty comments in the community when I share knowledge. 3. Someone posted disparaging contents to me on the public platform of the community 	<p>我在知乎共享知识时，</p> <ol style="list-style-type: none"> 1. 收到过粗鲁的评论。 2. 收到过让我讨厌的评论。 3. 有人在知乎社区的公共平台上发表了诋毁我的内容

APPENDIX 3

知乎

Q
首页
话题
发现
消息
提问

 Sarah Zh...

yixin.y.zhang@jyu.fi

3月25日 00:45 查看对话 | 回复 | 删除

我发送给 OoPsy : 您好!

我是张怡昕, Sarah. 在芬兰的University of Jyväskylä工作。我和我的学生正在做一个关于知乎社区知识分享的学术研究, 需要调查用户相关方面的真实想法, 您的回答对我们此次调研意义重大! 为了感谢您的支持, 我们将抽取50名用户送去用心准备的小礼物。

这份问卷大约需要您5-10分钟的时间。

为了确保填写的用户为指定的对象, 我们为您随机产生了一个邀请编号需要在问卷的首页输入。

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问卷的链接是 <http://privacysurvey.us-west-2.elasticbeanstalk.com/limesurvey/index.php/survey/index/sid/178422/newtest/Y/lang/zh-Hans>

谢谢!

怡昕

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